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ABSTRACT

This module is the second volume in a series of three publications on landscape management. The module contains five instructional units that cover the following topics: orientation; equipment; irrigation systems and maintenance; plant material identification and pests; and turf identification and pests. Each instructional unit follows a standard format that includes some or all of these eight basic components: performance objectives, suggested activities for teachers and students, information sheets, assignment sheets, job sheets, visual aids, tests, and answers to tests and assignment sheets. All of the unit components focus on measurable and observable learning outcomes and are designed for use for more than one lesson or class period. Instructional task analyses and 26 references are also included. (KC)

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Landscape Management: Field Specialist

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LANDSCAPE MANAGEMENT: FIELD SPECIALIST

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LANDSCAPE MANAGEMENT: FIELD SPECIALIST

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FOREWORD

Landscape Management: Field Specialist is the second volume of a series of instructional materials produced by the Mid-America Vocational Curriculum Consortium. The other publications are entitled *Landscape Management: Field Operator* and *Landscape Management: Field Supervisor.*

The success of this publication is due, in large part, to the capabilities of the personnel who worked with its development. The technical writers have numerous years of industry as well as teaching and writing experience. Assisting them in their efforts were committee representatives who brought with them technical expertise and experience related to the classroom and to the trade. To assure that the materials would parallel the industry environment and be accepted as a transportable basic teaching tool, other organizations and industry representatives were involved in the developmental phases of the manual. Appreciation is extended to them for their valuable contributions to the manual.

This publication is designed to assist teachers in improving instruction. As this publication is used, it is hoped that the student performance will improve and that students will be better able to assume a role in their chosen occupation. Every effort has been made to make this publication readable, and by all means, usable. Three vital parts of instruction have been intentionally omitted from these publications: motivation, personalization, and localization. Those areas are left to the individual instructors and the instructors should capitalize on them. Only then will this publication really become a vital part of the teaching-learning process.

It is the sincere belief of the MAVCC staff and all those members who served on the committee that this publication will allow the students to become better prepared and more effective members of the work force. If there is anything that we can do to help this publication become more useful to you, please let us know.

Ron Mehrer, Chairman
Board of Directors
Mid-America Vocational
Curriculum Consortium

Greg Pierce
Executive Director
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Curriculum Consortium

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Appreciation is extended to those individuals who contributed their time and talent to the development of *Landscape Management: Field Specialist*.

The contents of this publication were planned and reviewed by the following members of the Mid-America Vocational Curriculum Consortium landscape management committee:

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Special appreciation is extended to **Dan Fulkerson** for taking the photographs for this publication and to **Nancy Hilley** for the original artwork and pasteup of this book. Special thanks are also given to **Jay Albright**, Stillwater Equipment Company, for providing the equipment and his assistance in setting up the photographs for this book.

Gratitude is expressed to the employees of the Graphics Division of the Oklahoma State Department of Vocational-Technical Education for the phototypesetting and printing of this text.

Thanks are also extended to **Mary Kellum**, MAVCC Curriculum Specialist for her assistance with the editing of this book, as well as the coordination of the entire project.

USE OF THIS PUBLICATION

Instructional Units

Landscape Management: Field Specialist contains five units of instruction. Each instructional unit includes some or all of the basic components of a unit of instruction; performance objectives, suggested activities for teachers and students, information sheets, assignment sheets, job sheets, visual aids, tests, and answers to the tests. Units are planned for more than one lesson or class period of instruction.

Careful study of each instructional unit by the teacher will help to determine:

A. The amount of material that can be covered in each class period
B. The skills which must be demonstrated

    1. Supplies needed
    2. Equipment needed
    3. Amount of practice needed
    4. Amount of class time needed for demonstrations

C. Supplementary materials such as pamphlets or filmstrips that must be ordered
D. Resource people who must be contacted

Objectives

Each unit of instruction is based on performance objectives. These objectives state the goals of the course, thus providing a sense of direction and accomplishment for the student.

Performance objectives are stated in two forms: unit objectives, stating the subject matter to be covered in a unit of instruction; and specific objectives, stating the student performance necessary to reach the unit objective.

Since the objectives of the unit provide direction for the teaching-learning process, it is important for the teacher and students to have a common understanding of the intent of the objectives. A limited number of performance terms have been used in the objectives for this curriculum to assist in promoting the effectiveness of the communication among all individuals using the materials.

Reading of the objectives by the student should be followed by a class discussion to answer any questions concerning performance requirements for each instructional unit.

Teachers should feel free to add objectives which will fit the material to the needs of the students and community. When teachers add objectives, they should remember to supply the needed information, assignment and/or job sheets, and criterion tests.

Suggested Activities for the Instructor

Each unit of instruction has a suggested activities sheet outlining steps to follow in accomplishing specific objectives. Duties of instructors will vary according to the particular unit; however, for best use of the material they should include the following: provide students with objective sheet, information sheet, assignment sheets, and job sheets; preview filmstrips, make transparencies, and arrange for resource materials and people; discuss unit and specific objectives and information sheet; give test. Teachers are encouraged to use any additional instructional activities and teaching methods to aid students in accomplishing the objectives.

Information Sheets

Information sheets provide content essential for meeting the cognitive (knowledge) objectives in the unit. The teacher will find that the information sheets serve as an excellent guide for presenting the background knowledge necessary to develop the skill specified in the unit objective.

Students should read the information sheets before the information is discussed in class. Students may take additional notes on the information sheets.

Transparency Masters

Transparency masters provide information in a special way. The students may see as well as hear the material being presented, thus reinforcing the learning process. Transparencies may present new information or they may reinforce information presented in the information sheets. They are particularly effective when identification is necessary.

Transparencies should be made and placed in the notebook where they will be immediately available for use. Transparencies direct the class's attention to the topic of discussion. They should be left on the screen only when topics shown are under discussion.

Assignment Sheets

Assignment sheets give direction to study and furnish practice for paper and pencil activities to develop the knowledge which is a necessary prerequisite to skill development. These may be given to the student for completion in class or used for homework assignments. Answer sheets are provided which may be used by the student and/or teacher for checking student progress.

Job Sheets

Job sheets are an important segment of each unit. The instructor should be able to demonstrate the skills outlined in the job sheets. Procedures outlined in the job sheets give direction to the skill being taught and allow both student and teacher to check student progress toward the accomplishment of the skill. Job sheets provide a ready outline for students to follow if they have missed a demonstration. Job sheets also furnish potential employers with a picture of the skills being taught and the performances which might reasonably be expected from a person who has had this training.

Test and Evaluation

Paper-pencil and performance tests have been constructed to measure student achievement of each objective listed in the unit of instruction. Individual test items may be pulled out and used as a short test to determine student achievement of a particular objective. This kind of testing may be used as a daily quiz and will help the teacher spot difficulties being encountered by students in their efforts to accomplish the unit objective. Test items for objectives added by the teacher should be constructed and added to the test.

Test Answers

Test answers are provided for each unit. These may be used by the teacher and/or student for checking student achievement of the objectives.

LANDSCAPE MANAGEMENT: FIELD SPECIALIST

INSTRUCTIONAL/ TASK ANALYSIS

RELATED INFORMATION: What the Worker Should Know (Cognitive)	JOB TRAINING: What the Worker Should Be Able to Do (Psychomotor)

UNIT I: ORIENTATION

1. Terms and definitions
2. Major job responsibilities of a field specialist
3. Common job tasks of a field specialist
4. Record keeping forms involving a field specialist
5. Pesticide laws
6. Classes of certified applicators
7. Categories of commercial and non-commercial applicators
8. Certification and licensing of pesticide applicators

9. Complete a work order
10. Complete a time card

UNIT II: EQUIPMENT

1. Terms and definitions
2. Types of groundskeeping tractors
3. Types of mowers
4. Attachments for riding mowers and tractors
5. Other pieces of equipment used in landscaping

RELATED INFORMATION: What the Worker Should Know (Cognitive)	JOB TRAINING: What the Worker Should Be Able to Do (Psychomotor)
6. Equipment safety	
7. Basic types of tires used on landscaping equipment	
8. Types of fuel used for landscaping equipment	
9. Types of power take-off drives that may be used on tractors	
10. Chemicals that may be applied with a sprayer	
11. Spray drift and factors affecting it	
12. Pesticide safety	
13. Types of pesticide exposures	
14. Essentials of effective spraying	
15. Basic types of sprayers	
16. Parts of a sprayer	
17. Basic nozzle spray patterns	
18. Basic parts of a nozzle	
19. Care and storage of a sprayer	
20. Purpose of calibration	
21. Preparing a sprayer for calibration	
	22. Calibrate a sprayer by the acre method
	23. Calibrate a sprayer by the 1000 sq. ft. method
	24. Calibrate a sprayer by the nomograph method
	25. Explain how to clean a sprayer

RELATED INFORMATION: What the Worker Should Know (Cognitive)	JOB TRAINING: What the Worker Should Be Able to Do (Psychomotor)
	26. Operate a manual transmission tractor
	27. Load and secure equipment
	28. Service and maintain a lawn tractor
	29. Calibrate and use a sprayer

UNIT III: IRRIGATION SYSTEMS AND MAINTENANCE

1. Terms and definitions	
2. Basic parts of a sprinkler system	
3. Ways sprinkler heads distribute water	
4. Types of sprinkler heads	
5. Basic sprinkler head distribution patterns	
6. Types of pipes and fittings used for sprinkler systems	
7. Methods of operating sprinkler systems	
8. Miscellaneous equipment used in a sprinkler system	
9. Common needs for servicing a sprinkler system	
10. Winterizing irrigation systems	
	11. Identify parts of a sprinkler system
	12. Read an irrigation system drawing
	13. Repair and replace PVC pipe and fittings
	14. Repair and replace polyethylene pipe and fittings
	15. Replace a sprinkler head

RELATED INFORMATION: What the Worker Should Know (Cognitive)	JOB TRAINING: What the Worker Should Be Able to Do (Psychomotor)

UNIT IV: PLANT MATERIAL IDENTIFICATION AND PESTS

1. Terms and definitions	
2. Characteristics used in plant identification	
3. Common flower forms	
4. Common leaf shapes	
5. Common leaf tips	
6. Common leaf margins	
7. Basic leaf types	
8. Leaf arrangements on a stem	
9. How a lenticel can be used in identification	
10. Differences that can be seen in bark that help in identification	
11. Basic overall forms of plants	
12. Reasons for pruning	
13. Pruning safety rules	
14. Types of plants and approximate times they should be pruned	
15. Insect pests and damage	
16. Plant disease problems	
17. Common plant groups	
	18. Identify chemical treatments for insect pests
	19. Identify chemical treatments for plant diseases

RELATED INFORMATION: What the Worker Should Know (Cognitive)	JOB TRAINING: What the Worker Should Be Able to Do (Psychomotor)
	20. Identify specific plants
	21. List local plants
	22. Identify specific plant diseases
	23. Identify specific insect pests
	24. Prune branches
	25. Treat tree injury wounds

UNIT V: TURF IDENTIFICATION AND PESTS

1. Terms and definitions	
2. Soil pH	
3. Major and minor turfgrass nutrients	
4. Cool season grasses	
5. Warm season grasses	
6. Hardiness zones and what grasses grow there	
7. Determining proper turf selection	
8. Common turf insect pests	
9. Common turf weed problems	
10. Common turf diseases	
	11. Select appropriate grasses for various conditions and zones
	12. Locate and describe local turf insects
	13. Locate and describe local turf weeds
	14. Describe symptoms for various turf diseases

RELATED INFORMATION: What the Worker Should Know (Cognitive)	JOB TRAINING: What the Worker Should Be Able to Do (Psychomotor)
	15. Answer questions using a chemical control chart provided by instructor
	16. Seed a lawn using a hydromulcher
	17. Overseed a lawn using a seeder
	18. Sprig lawn using a tractor tiller
	19. Use a drop-type fertilizer spreader
	20. Use a broadcast or rotary-type fertilizer spreader

LANDSCAPE MANAGEMENT: FIELD SPECIALIST

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ORIENTATION
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to list the basic job duties and responsibilities of the field specialist and complete a work order and a time card. Competencies will be demonstrated by completing the assignment sheets and the unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms related to an orientation of the field specialist occupation with the correct definitions.
2. Select from a list the major job responsibilities of a field specialist.
3. List common job tasks of a field specialist.
4. Identify the major types of record keeping forms involving a field specialist.
5. Select true statements concerning pesticide laws.
6. Match classes of certified applicators with their descriptions.
7. Name categories of commercial and noncommercial applicators.
8. Complete statements concerning certification and licensing of pesticide applicators.
9. Complete a work order. (Assignment Sheet #1)
10. Complete a time card. (Assignment Sheet #2)

ORIENTATION
UNIT I

SUGGESTED ACTIVITIES

A. Obtain additional materials and/or invite resource people to class to supplement/reinforce information provided in this unit of instruction.

(NOTE: This activity should be completed prior to the teaching of this unit.)

B. Make transparencies from the transparency masters included with this unit.

C. Provide students with objective sheet.

D. Discuss unit and specific objectives.

E. Provide students with information and assignment sheets.

F. Discuss information and assignment sheets.

(NOTE: Use the transparencies to enhance the information as needed.)

G. Integrate the following activities throughout the teaching of this unit:

1. Research your state laws for the exact requirements and procedures to comply with chemical applicator licensing. This can be done by calling your state department of agriculture or the state cooperative extension service.

2. Have each student apply for an applicator's license (private, commercial, or service technician).

3. Show local examples of record keeping forms.

4. Discuss common mistakes made in filling out record keeping forms and what these mistakes can cost the employer.

5. Display safety posters dealing with pesticide chemical use.

6. Meet individually with students to evaluate their progress through this unit of instruction, and indicate to them possible areas for improvement.

H. Give test.

I. Evaluate test.

J. Reteach if necessary.

RESOURCES USED IN DEVELOPING THIS UNIT

A. O. Norman Nesheim. *Applying Pesticides Correctly*. Stillwater, OK: Oklahoma State University Extension Service.

B. *Commercial Pesticide Applicator*. Louisiana Cooperative Extension Service and Louisiana Department of Agriculture.

SUGGESTED SUPPLEMENTAL RESOURCE

Pesticides: Safe Handling and Use. (Filmstrips or slides with accompanying cassettes and study guides, #260)

Available from:
Bergwall Productions, Inc.
P.O. Box 238
Garden City, NY 11530-0238
800-645-3565 or 516-222-1111 in New York

ORIENTATION
UNIT I

INFORMATION SHEET

I. **Terms and definitions**

A. Bid forms — Printed documents for a landscape organization to fill in with their offer of a price that they would accept to do a job

(NOTE: These are very similar to work orders, but are not considered work orders until they are signed and approved by the customer.)

B. Certified pesticide applicator — Any individual who is certified to use or supervise the use of any pesticide which is classified for restricted use

(NOTE: In some states this person **cannot** supervise others.)

C. Inventory controls — Records to keep track of materials and supplies

D. Job responsibilities — General fields of knowledge and experience in which a worker is expected to perform

E. Job tasks — Specific tasks or jobs that a worker is expected to complete

F. Pesticide applicator — Person who applies pesticides

G. Pesticide laws — Laws passed in every state to implement federal laws and regulations that deal with pesticide application

H. Record keeping — "Paperwork" or the putting down on paper the information that a manager needs to keep track of finances and jobs performed by the company or organization

(NOTE: Sometimes this is done to comply with government regulations.)

I. Service technician — A person employed by a licensed commercial or non-commercial applicator who makes the actual application of a pesticide as long as the person is not the certified applicator

(NOTE: This category may not be allowed in your state. Check with your instructor.)

J. Time sheets — Records to keep track of labor costs and payroll

K. Work orders — Records kept of every customer, what work is to be done, and when it is to be done

INFORMATION SHEET

II. **Common job responsibilities of a field specialist**

A. ***Large equipment operation and maintenance*** — Handles the operation, basic service, and maintenance of equipment such as tractors, riding lawn mowers and attachments, sprayers, skid loaders, tree spades, stump chippers, trenchers, hydro-mulchers, and trucksters.

B. ***Sprinkler system installation and maintenance*** — Knows the basic components of a sprinkler system and how they work together in the system. This includes repairing and/or replacing components, reading the layout drawings, and setting and adjusting sprinkler heads, nozzle sizes, and head type spacings and patterns.

C. ***Plant identification and pruning*** — Knows how to identify plants by using basic characteristics such as flowers and fruits, leaves, bark, buds, and general shape. Also knows major pruning techniques and can identify common insects and diseases of landscape plants.

D. ***Turf identification and care*** — Knows common types of grasses and their uses, characteristics, and installation methods. Also knows basic insects, diseases, and weeds and how to treat and control these problems.

III. **Common job tasks of a field specialist**

A. Mow lawns at proper heights with appropriate equipment.

B. Spray pesticides safely using appropriate materials at appropriate times, and care for the sprayer.

C. Load and secure equipment for transportation.

D. Service and check equipment used.

E. Repair and replace watering equipment.

F. Set and adjust heads in sprinkler systems.

G. Set sprinkler head spacing and patterns.

H. Service and check parts of a sprinkler system.

I. Read simple sprinkler system drawings.

J. Winterize sprinkler system.

K. Plant landscape plant materials correctly.

L. Prune plant materials correctly.

M. Water plant materials and turf correctly.

N. Fertilize plant materials and turf correctly.

O. Identify plant materials.

INFORMATION SHEET

P. Identify common diseases of plant materials and turf.

Q. Identify common insect pests of plant materials and turf.

R. Identify common types of grasses and their care.

S. Install common types of grasses.

T. Adjust pH for problems with turf and plant materials.

U. Fill out various records as the employer may require.

(NOTE: As your experience in this occupation grows, you will probably be assigned additional job tasks depending on your ability and work record with your employer. In some organizations the field specialist may supervise the field operator.)

IV. **Major types of record keeping forms involving a field specialist** (Transparencies 1-3)

(NOTE: All employers require some "paperwork" or record keeping. It is very important that you pay careful attention to properly filling out these forms because they are the employer's documentation for financial records.)

A. Inventory controls (Transparency 1)

1. These are used to monitor the flow of materials and supplies. Every manager has to keep the costs as low as possible. The only way to do this is to know where the costs are being accumulated.

2. Inventory controls are commonly used for pesticides, plant materials, fertilizers, tools, and equipment.

3. Usually the information required is the date, your name, the field supervisor (foreman), the customer or job that the materials are being used for, and the amount taken.

B. Time sheets or cards (Transparency 2)

1. These are used to reflect the labor costs within the company or organization. Every manager tries to keep labor costs as low and efficient as possible.

2. These are used to calculate payroll for hourly employees.

3. Usually the information required would be the date, your name and social security number, the work order number (or job name), the specific task completed, and the number of hours it took to complete this task.

(NOTE: You may have done several tasks or only one but the total number of hours that you worked must be accounted for on the time sheet.)

INFORMATION SHEET

C. Work order or job records (Transparency 3)

1. These are used to keep a record of all jobs requested and completed.

2. Usually the information required is name and address of the customer, crew and supervisor doing the job, times the crew left the shop and returned from the job, what the job consists of, and the charges to the customer.

(NOTE: Bid or estimate forms are filled out with much the same information but are not work or job orders until signed and approved by the customer.)

V. Highlights of pesticide laws

(NOTE: Every state has passed laws and adopted regulations to implement federal laws and regulations that deal with pesticide application. The accurate information about your state laws can be obtained by contacting your State Department of Agriculture or your local State Cooperative Extension Service.)

A. Requires annual registration with the Environmental Protection Agency (EPA) of all pesticides distributed, sold, or offered for sale.

B. Pesticides are divided into two classes.

1. General use — May be purchased by the general public and applied according to the label directions.

2. Restricted use — May be purchased and applied only by certified applicators or individuals working under the direct supervision of a certified applicator if allowed in your state.

FIGURE 1 — Sample Label

Restricted Use Pesticide

For retail sale to and use only by certified applicators or persons under their direct supervision and only for those uses covered by the certified applicator's certification.

INFORMATION SHEET

C. Federal laws state that it is **unlawful** to distribute, sell, or use any registered pesticide in a manner inconsistent with its labeling.

D. Pesticide dealers must have a license.

E. Restricted use pesticide dealers must keep records for at least two years showing brand name, EPA registration number, date of sale, person to whom sold, and name of certified applicator.

VI. Classes of certified applicators

A. ***Private applicator*** — Any person who uses or supervises the use of any restricted pesticide for purposes of producing any agricultural commodity on property owned or rented by the person or his employer or if applied without monetary pay other than for trading of personal services between agriculture producers.

Examples: Farmers, ranchers, growers

B. ***Commercial applicator*** — Any person who engages in commercial (for profit) application of pesticides.

Example: Herbicide/insect spraying company

C. ***Noncommercial applicator*** — Any person, other than commercial or private applicator, who uses or supervises the use of a restricted-use pesticide under the supervision of a person who owns or manages the property. They are certified to use restricted-use pesticides in the same manner as required for commercial applicators.

Example: Government employee

VII. Categories of commercial and noncommercial applicators

(NOTE: Some states vary on the exact wording or classifications of these categories.)

A. Agricultural pest control

1. Plant
2. Animal

B. Forest pest control

C. Ornamental and turf

D. Greenhouse

E. Seed treatment

F. Aquatic

G. Right-of-way

INFORMATION SHEET

H. General

1. Structural
2. Fumigation
3. Food processing

I. Public health

J. Regulatory

K. Demonstration and research

L. Bird and predatory animal

M. Pressure facility timber treating

N. Ground line utility pole timber treating

O. Construction industry timber treating

P. Home owner timber treating

Q. Consultants

(NOTE: A person can take as many different category examinations as desired.)

VIII. Certification and licensing of pesticide applicators

A. General procedure for certification

1. Pass written examination.
2. Complete application.
3. Pay the fee.
4. Renew as necessary.

B. Certification is good for a set number of years depending on state (1, 3, 5 years) and may be renewed either by reexamination or by obtaining a set number of continuing education units in the category by attending various meetings and training during the time period.

C. Private applicators are certified after completion of training available at their county cooperative extension service offices and the completion of an application form. There is also usually a fee.

Inventory Controls

Daily Materials and Equipment Inventory Date 7/2/88

Item	Taken	Used	Job Name
Gravel — 3/4" Yellow			
Gravel — 3/4" Gray			
Plastic			
Railroad ties			
Lime			
10-6-4	100 lbs.	100 lbs.	Smith
Sunny seed			
Shady seed			
Long tree stakes			
Short (2') tree stakes			
Peat moss	12 cu. ft.	12 cu. ft.	Smith
Humus			
Mulch			

Equipment	Taken	Hrs. Used	Job Name
Grading tractor			
Backhoe — loader tractor			
Power rake			
Chain saw			
General use tractor			
Rear-tined rototiller			
Front mount mower			
Lawn spiker			
Lawn tractor			
Broadcast spreader			
Drop-type spreader			
Rototiller — tractor mount	1	5	Smith

Time Sheet

Daily Time Sheet

Client's Name: Bill Jones Address: 508 E. Avenue B Date: 8/1/88

Employee's Name	Hours	Description of Work Performed	
John Doe	2	weeding beds	
	6	trimming hedges	

Equipment Used	Hours	Materials Used (not plant mat.)	Quantity
hand tools	8	rake, hoe, shovel	
electric hedge trimmers	6	———	
electric generator	6	———	

NOTE: Enter all labor, equipment, and materials same day as used.

Work Order

Work Order

8085

MAVCC Landscaping
1500 W. 7th
Stillwater, OK 74074
Phone (405) 377-2000
or (800) 654-3988

Customer Name T. R. Williams

Address 601 E. 6th St., Anywhere, U.S.A.

Date 8/8/98

Time In 12 noon Time Out 9:00 a.m.

Supervisor Sam Hughes

Crew Mary Taylor and Steven Nichols

Job Description	Price
Mowing and trimming front and back lawn of Williams' estate	$50.00
total	$50.00

T. R. Williams
Customer Signature

ORIENTATION
UNIT I

ASSIGNMENT SHEET #1 — COMPLETE A WORK ORDER

NAME _____ SCORE _____

Directions: Using the form which follows, correctly complete a work order with this information:

Customer — John Doe
1111 Main St.
Anywhere, U.S.A.

Work will begin 8:00 a.m. - 9/1/88.
Crew #1, whose supervisor is Marie, will be sent to do the work.
The crew members are Ralph, Susan, and Jackie.
The workers returned at 12:00 noon.
The job consists of installing 3—5 gal crab apples at $25.00 each and 15—1 gal pfitzer junipers at $7.50 each.

ASSIGNMENT SHEET #1

Work Order

22457

MAVCC Landscaping
1500 W. 7th
Stillwater, OK 74074
Phone (405) 377-2000
or (800) 654-3988

Customer Name _____

Address _____

Date _____

Time In _____ Time Out _____

Supervisor _____

Crew _____

Job Description	Price

_____
Customer Signature

ORIENTATION
UNIT I

ASSIGNMENT SHEET #2 — COMPLETE A TIME CARD

NAME _____ SCORE _____

Directions: Using the form which follows complete a time card using your name and social security number. Other pertinent information is as follows:

Date: 9/2/88

Work Order #	Task	Hours
219467	Weeding beds	4
219468	Spraying herbicide	4

ASSIGNMENT SHEET #2

Daily Time Card

Name _____

ID No. _____

Dept. _____

Date _____

Employee Signature _____

Approval _____

Work Order No.	Reg. Hrs. Wkd.	O.T. Hrs. Wkd.	Description of Work

Hours Taken

_____ Vacation _____ Administrative

_____ Sick _____ Without Pay

_____ Other — explain _____

ORIENTATION
UNIT I

ANSWERS TO ASSIGNMENT SHEETS

ASSIGNMENT SHEET #1

Work Order

22457

MAVCC Landscaping
1500 W. 7th
Stillwater, OK 74074
Phone (405) 377-2000
or (800) 654-3988

Customer Name John Doe

Address 1111 Main St., Anywhere, U.S.A.

Date 9/1/88

Time In 12 noon Time Out 8:00 a.m.

Supervisor Marie (crew #1)

Crew Ralph, Susan, Jackie

Job Description	Price
3 5 gal. crab apples at $25.00 ea.	$75.00
15 1 gal. pfitzer junipers at $7.50 ea.	$112.50
total	$187.50

Customer Signature

ANSWERS TO ASSIGNMENT SHEETS

ASSIGNMENT SHEET #2

Daily Time Card

Name Student's name

ID No. Student's SSN

Dept. _____

Date 9/2/88

Employee Signature Student's signature

Approval _____

Work Order No.	Reg. Hrs. Wkd.	O.T. Hrs. Wkd.	Description of Work
219-467	4		weeding beds
219-468	4		spraying herbicide
	8	hrs	total

Hours Taken

____ Vacation ____ Administrative

____ Sick ____ Without Pay

____ Other — explain _____

ORIENTATION
UNIT I

TEST

NAME _____ SCORE _____

1. Match the terms on the right with the correct definitions.

_____a.	Records to keep track of materials and supplies	1. Bid forms
_____b.	General fields of knowledge and experience in which a worker is expected to perform	2. Certified pesticide applicator
_____c.	Specific tasks or jobs that a worker is expected to complete	3. Inventory controls
_____d.	Records to keep track of labor costs and payroll	4. Job responsibilities
_____e.	Records kept of every customer, what work is to be done, and when it is to be done	5. Job tasks
_____f.	Putting down on paper the information that a manager needs to keep track of finances and jobs performed by the company or organization	6. Pesticide applicator
_____g.	Laws passed in every state to implement federal laws and regulations that deal with pesticide application	7. Pesticide laws
_____h.	Printed documents for a landscape organization to fill in with their offer of a price that they would accept to do a job	8. Record keeping
_____i.	A person who applies pesticides	9. Service technician
_____j.	A person employed by a licensed commercial or noncommercial applicator who makes the actual application of a pesticide as long as the person is not the certified applicator	10. Time sheets
_____k.	Any individual who is certified to use or supervise the use of any pesticide which is classified for restricted use	11. Work orders

TEST

2. Select from the following list the major job responsibilities of a field specialist by placing an "X" next to the correct responsibilities.

   _____a. Work crew supervision

   _____b. Plant identification and pruning

   _____c. Sprinkler system installation and maintenance

   _____d. Landscape design

   _____e. Large equipment operation and maintenance

   _____f. Large equipment purchasing and storage

   _____g. Turf identification and care

3. List ten (10) common job tasks of a field specialist.

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

   f. _____

   g. _____

   h. _____

   i. _____

   j. _____

TEST

4. Identify the following major types of record keeping forms.

Date 7/2/88

Item	Taken	Used	Job Name
Gravel — ¾" Yellow			
Gravel — ¾" Gray			
Plastic			
Railroad ties			
Lime			
10-6-4	100 lbs.	100 lbs.	Smith
Sunny seed			
Shady seed			
Long tree stakes			
Short (2') tree stakes			
Peat moss	12 cu. ft.	12 cu. ft.	Smith
Humus			
Mulch			

Equipment	Taken	Hrs. Used	Job Name
Grading tractor			
Backhoe — loader tractor			
Power rake			
Chain saw			
General use tractor			
Rear-tined rototiller			
Front mount mower			
Lawn spiker			
Lawn tractor			
Broadcast spreader			
Drop-type spreader			
Rototiller — tractor mount	1	5	Smith

a. _____

TEST

8085

MAVCC Landscaping
1500 W. 7th
Stillwater, OK 74074
Phone (405) 377-2000
or (800) 654-3988

Customer Name T.R. Williams
Address 601 E. 6th St., Anywhere, U.S.A.
Date 8/8/98
Time In 12 noon Time Out 9:00 a.m.
Supervisor Sam Hughes
Crew Mary Taylor and Steven Nichols

Job Description	Price
Mowing and trimming front and back lawn of Williams' estate	$50.00
total	$50.00

T.R. Williams
Customer Signature

b. _____

Client's Name Bill Jones Address 508 E. Avenue B Date 8/1/98

Employee's Name	Hours	Description of Work Performed	
John Doe	2	weeding beds	
	6	trimming hedges	

Equipment Used	Hours	Materials Used (not plant mat.)	Quantity
hand tools	8	rake, hoe, shovel	
electric hedge trimmers	6	———	
electric generator	6	———	

NOTE: Enter all labor, equipment, and materials same day as used.

c. _____

TEST

5. Select true statements concerning pesticide laws by placing either a T or F in the blanks to indicate if the statement is true or false.

_____a. Every state has adopted its own pesticide laws and regulations, and these may vary from state to state.

_____b. Pesticides classed as general use may be purchased only by certified applicators.

_____c. Pesticides classed as restricted use may be purchased and applied by the general public.

_____d. It is acceptable to use any registered pesticide in a manner inconsistent with its labeling.

_____e. Pesticide dealers must have a license.

_____f. Restricted use pesticide dealers must keep records for at least the last 2 years.

6. Match the classes of certified applicators on the right with the correct descriptions.

_____a. Any person who uses or supervises the use of any restricted pesticide for purposes of producing any agricultural commodity on property owned or rented by the person

_____b. Any person who engages in application of pesticides for profit

_____c. Any person other than commercial or private applicator who uses or supervises the use of a restricted use pesticide under the supervision of a person who owns or manages the property

1. Commercial applicator
2. Noncommercial applicator
3. Private applicator

7. Name four categories of commercial and noncommercial applicators.

a. _____

b. _____

c. _____

d. _____

TEST

8. Complete the following statements concerning certification and licensing of pesticide applicators by filling in the blanks.

   a. The general procedure for certification is to _____

   _____

   b. Certification is good for _____ year(s) in my state.

   c. Renewal may be accomplished by _____

   _____

(NOTE: If the following activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

9. Complete a work order. (Assignment Sheet #1)

10. Complete a time card. (Assignment Sheet #2)

ORIENTATION
UNIT I

ANSWERS TO TEST

1.

a.	3	e.	11	i.	6
b.	4	f.	8	j.	9
c.	5	g.	7	k.	2
d.	10	h.	1		

2. b, c, e, g

3. Any ten of the following:

   a. Mow lawns at proper heights with appropriate equipment.
   b. Spray pesticides using appropriate materials at appropriate times, and care for the sprayer.
   c. Load and secure equipment for transportation.
   d. Service and check equipment used.
   e. Repair and replace watering equipment.
   f. Set and adjust heads in sprinkler systems.
   g. Set sprinkler head spacing and patterns.
   h. Service and check parts of a sprinkler system.
   i. Read simple sprinkler system drawings.
   j. Winterize sprinkler system.
   k. Plant landscape plant materials correctly.
   l. Prune plant materials correctly.
   m. Water plant materials and turf correctly.
   n. Fertilize plant materials and turf correctly.
   o. Identify plant materials.
   p. Identify common diseases of plant materials and turf.
   q. Identify common insect pests of plant materials and turf.
   r. Identify common types of grasses and their care.
   s. Install common types of grasses.
   t. Adjust pH for problems with turf and plant materials.
   u. Fill out various records as the employer may require.

4. a. Inventory control
   b. Work order
   c. Time card

5.

a.	T	d.	F
b.	F	e.	T
c.	F	f.	T

ANSWERS TO TEST

6. a. 3
   b. 1
   c. 2

7. Any four of the following:

   a. Agricultural pest control
   b. Forest pest control
   c. Ornamental and turf
   d. Greenhouse
   e. Seed treatment
   f. Aquatic
   g. Right-of-way
   h. General
   i. Public health
   j. Regulatory
   k. Demonstration and research
   l. Bird and predatory animal
   m. Pressure facility timber treating
   n. Ground line utility pole timber treating
   o. Construction industry timber treating
   p. Home owner timber treating
   q. Consultants

8. Answers evaluated by instructor (states vary)

9.-10. Evaluated to the satisfaction of the instructor

EQUIPMENT
UNIT II

UNIT OBJECTIVE

After completion of this unit, the student should be able to operate, service, and maintain various equipment. Competencies will be demonstrated by completing the assignment sheets, job sheets, and the unit tests with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms related to equipment with the correct definitions.
2. Match the types of groundskeeping tractors with their descriptions.
3. Identify two types of mowers.
4. Identify attachments for riding mowers and tractors.
5. Identify other pieces of equipment used in landscaping.
6. Select true statements about equipment safety.
7. Distinguish among the basic types of tires used on landscaping equipment.
8. List types of fuel used for landscaping equipment.
9. List types of power take-off drives that may be used on tractors.
10. Match the chemicals that may be applied with a sprayer with the correct definitions.

OBJECTIVE SHEET

11. Complete statements concerning spray drift and factors affecting it.
12. Select true statements concerning pesticide safety.
13. Distinguish among the types of pesticide exposures.
14. Name the three essentials of effective spraying.
15. Identify basic types of sprayers.
16. Match major parts of a sprayer with the correct descriptions.
17. Identify basic nozzle spray patterns.
18. Identify basic parts of a nozzle.
19. Complete statements concerning the care and storage of a sprayer.
20. State the purpose of calibration.
21. Name things you should do in preparing a sprayer for calibration.
22. Calibrate a sprayer by the acre method. (Assignment Sheet #1)
23. Calibrate a sprayer by the 1000 sq. ft. method. (Assignment Sheet #2)
24. Calibrate a sprayer by the nomograph method. (Assignment Sheet #3)
25. Explain how to clean a sprayer. (Assignment Sheet #4)
26. Demonstrate the ability to:
    a. Operate a manual transmission tractor. (Job Sheet #1)
    b. Load and secure equipment. (Job Sheet #2)
    c. Service and maintain a lawn tractor. (Job Sheet #3)
    d. Calibrate and use a sprayer. (Job Sheet #4)

EQUIPMENT
UNIT II

SUGGESTED ACTIVITIES

A. Obtain additional materials and/or invite resource people to class to supplement/reinforce information provided in this unit of instruction.

(NOTE: This activity should be completed prior to the teaching of this unit.)

B. Make a transparency from the transparency master included with this unit.

C. Provide students with objective sheet.

D. Discuss unit and specific objectives.

E. Provide students with information and assignment sheets.

F. Discuss information and assignment sheets.

(NOTE: Use the transparency to enhance the information as needed.)

G. Provide students with job sheets.

H. Discuss and demonstrate the procedures outlined in the job sheets.

I. Integrate the following activities throughout the teaching of this unit:

1. Visit a supplier that sells various types of equipment discussed in this unit and discuss the various features available and the use of each.

2. Try to give students as much experience as possible with operation of the various equipment.

3. Show slides and films dealing with equipment and safety. Suggested resources are listed on the next page.

4. Discuss licensing required by your state for operating (driving) large equipment and for applying pesticides.

5. Meet individually with students to evaluate their progress through this unit of instruction, and indicate to them possible areas for improvement.

J. Give test.

K. Evaluate test.

L. Reteach if necessary.

RESOURCES USED IN DEVELOPING THIS UNIT

A. *Landscape Management*, July 1987, Volume 26, #7, May 1987, Volume 26, #5. Cleveland, OH: Harcourt, Brace, Jovanovich.

B. *Grounds Maintenance*, August 1987 Volume 22 #8, April 1987 Volume 22 #4. Overland Park, KS: Intertec Publishing Co.

C. Calvin, Thomas S. *Grounds Keeping Equipment, Volume 1*. Athens, GA: American Association for Vocational Instructional Materials, 1974.

D. *Maintenance Calendar for Bentgrass Putting Greens*, Wayne Huffine, R.V. Sturgeon, Jr., and Ken Pinkston. Oklahoma State University Cooperative Extension Service.

E. *Fundamentals of Machine Operation: Crop Chemicals*. Moline, IL: Deere & Company, 1982.

SUGGESTED SUPPLEMENTAL RESOURCES

A. Slide films or slide sets with study guides

1. *Understanding and Safe Use of Pesticides* (1108-1.1)
2. *Selecting and Handling Pesticides* (1108-1.2)
3. *Calibrating and Applying Pesticides Safely* (1108-1.3)

B. Transparency set with study guide — *Safe Use of Pesticides* (T790)

Supplemental resources A and B are available from:

Vocational Agriculture Service
College of Agriculture
University of Illinois
1401 S. Maryland Drive
Urbana, IL 61801
Telephone — 217/333-3871

C. AV slide set — *Applying Pesticides*

D. Computer software — *Sprayer Calibration*

1. #AS059 for Apple II+, IIc, IIe
2. #AS060 for TRS-80 Models I, III, 4

Supplemental resources C and D are available from:

AAVIM
120 Driftmier Center
Athens, GA 30602
Telephone — 404/542-2586

EQUIPMENT
UNIT II

INFORMATION SHEET

I. **Terms and definitions**

A. Acre — An area of land equal to 43,560 sq. ft.

B. Acute toxicity — The sudden onset of chemical poisoning symptoms from one exposure to a harmful chemical

C. Antidote — A remedy to counteract the effects of poison

D. Application rate — Amount of chemical applied per acre

E. Articulated equipment — Implements which are connected with joints

(CAUTION: These machines roll easily and can crush you. Extreme care must be used when operating them, especially on slopes.)

F. Boom — Long pipe or tubing with several nozzles used to apply chemicals over a wide area at one time

G. Calibrate — To determine the application rate of a sprayer or spreader

H. Chronic toxicity — The gradual onset of chemical poisoning symptoms from frequent exposures over a long time to a harmful pesticide

I. Contaminate — To accidentally poison desirable plants, animals, people, food, supplies, or the environment with harmful chemicals

J. Exposure — Direct or indirect contact with a harmful chemical

K. Ground driven — Attachments that are operated by the action of being pulled or pushed by the tractor

L. Hydraulic — Operated or moved by means of water or other liquid in motion

M. Pest — A plant or animal that annoys or is harmful to humans

Example: Weeds, insects, diseases

N. Pneumatic — Operated or moved by means of air or other gas under pressure

O. Poison — A substance that through its chemical action can kill or injure an organism

P. Power take-off (PTO) — Supplementary mechanism enabling the engine power to be used to operate an attachment

INFORMATION SHEET

Q. Three-point hitch — Mechanism on the back of a tractor with two hydraulic arms which connect to an implement and lift or lower it; also has a top link used as a final connection between implement and tractor

II. **Types of groundskeeping tractors**

A. Riding lawn mower — 5-25 horsepower mounted with a mower attachment

(NOTE: This equipment is primarily designed for mowing.)

INFORMATION SHEET

B. Lawn (small) tractor — 7-18 horsepower with a large variety of attachments

(NOTE: This equipment can be used for many jobs depending on the attachments used.)

C. Lawn and garden (large) tractor — 18-80 horsepower or more with a large variety of attachments

(NOTE: This equipment is designed for the larger jobs.)

INFORMATION SHEET

III. Types of mowers

A. Reel

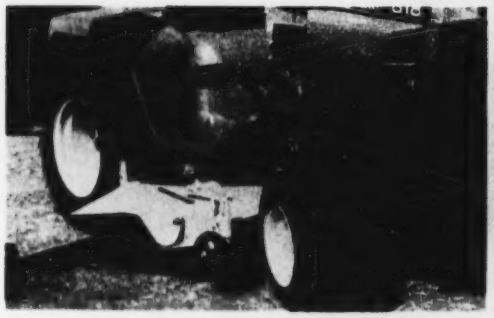
B. Rotary

INFORMATION SHEET

IV. Attachments for mowers and tractors

(NOTE: Most of the following attachments are for use with a tractor although many smaller mowers also have a few attachments that can be used.)

A. Belly (deck) mower—Mounted to the bottom of the tractor or mower



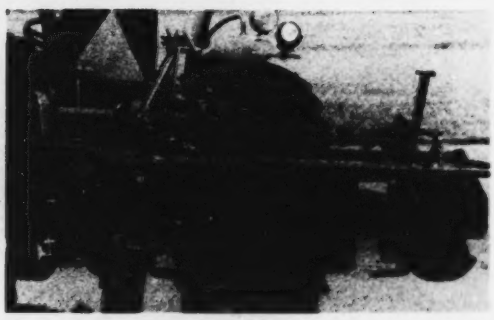
B. Grooming mower—Rests on its own wheels for mowing height; front or rear attachment

C. Brush hog—For rough mowing of brush and pastures

D. Disk

E. Landscape rake

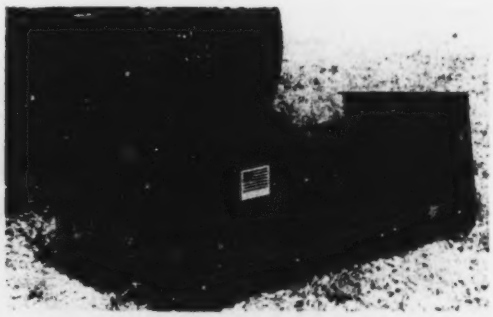
F. Rotary tiller



INFORMATION SHEET

G. Wood splitter

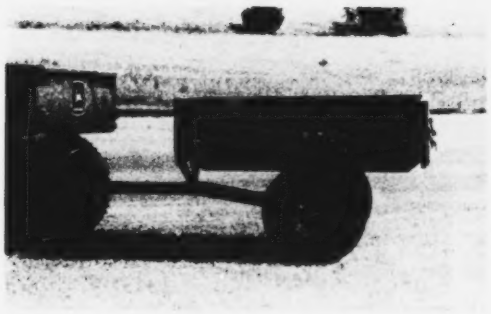
H. Box blade—Used for leveling and contouring surfaces



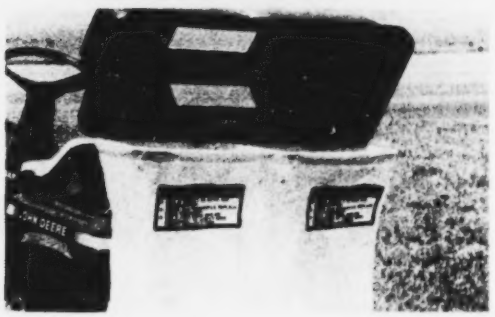
I. Scraper blade—Used primarily for smoothing

J. Post hole auger—Digs holes for setting fence posts or plants

K. Utility cart



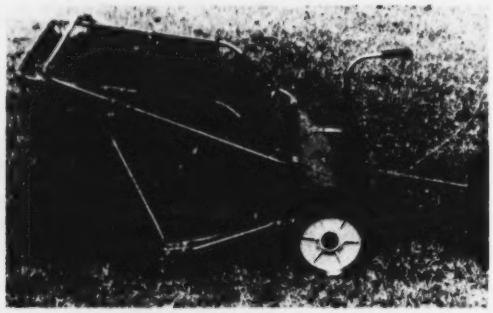
L. Grass catcher/bagger



INFORMATION SHEET

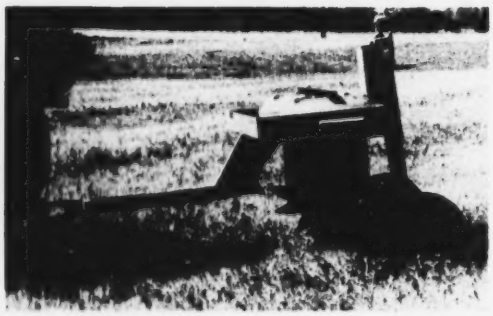
M. Seed/fertilizer spreader

N. Sweeper—Acts as a vacuum to collect leaves and grass clippings from lawn areas



O. Sprayer—Used for spraying herbicides and insecticides

P. Lawn aerator—Used to punch holes in lawn areas to encourage air infiltration into the soil for healthier turf



Q. Front-end loader

R. Rotary broom (brush)

INFORMATION SHEET

S. Front blade—Pushes materials to a desired location

V. Other equipment used in landscaping

A. Skid steer loader (Bobcat)—Used for moving loads and other jobs with the different attachments available such as backhoe, bucket, forklift, and blade.

B. Tree spade—Used for transplanting large trees

INFORMATION SHEET

C. Stump chipper—Used for removing stumps

D. Backhoe with bucket and blade—Used for digging trenches and large holes, scooping up dirt, and smoothing ground after digging

E. Excavator—Used for digging trenches and large holes; has tracks which are well suited for muddy, sandy, or rocky terrains without leaving deep ruts

30

INFORMATION SHEET

F. Trencher—Used for digging narrow trenches for utility lines, edging, sprinkler lines, etc.

G. Hydromulcher or hydroseeder—Used for applying grass seed, pulp mulch, and fertilizer

H. Truckster—Used for transporting materials, equipment, and personnel; hauling debris; and pulling various attachments such as spreaders and sprayers

INFORMATION SHEET

VI. Equipment safety

A. Always read the operator's manual before operating any tractor or equipment for the proper operation of that particular model of equipment.

B. Never bypass a safety device or guard on a machine.

C. Don't wear loose, frayed, or bulky clothing. It may become caught in revolving parts.

D. Wear heavy shoes with steel toes.

E. Wear a respirator in very dusty conditions.

F. Wear safety glasses or goggles if needed for eye protection.

G. Wear hearing protection when using loud equipment.

H. Keep alert to prevent injury to yourself and others.

I. Check tractor platform, steps, and pedals for mud or grease to prevent slipping.

J. Do not wear radio head phones when operating equipment.

K. Be sure all guards and shields are in place before starting engine.

L. Watch for hidden objects on the ground.

M. Watch for overhead objects such as tree limbs.

N. Remember to watch for those who may not be looking for you.

O. Slow down when operating on slopes.

P. Back up hills if possible; it is safer than driving up hills.

Q. When going down hills, keep in gear to act as a brake.

R. Signal and slow down when turning.

S. Look carefully behind you when backing.

T. Don't "horse around" when operating machinery.

U. Let out the clutch slowly to avoid lurching forward.

V. Never give rides on a tractor.

INFORMATION SHEET

W. Always use seat belts as required, especially on tractors and equipment equipped with a roll bar.

VII. Basic types of tires used on landscaping equipment

A. Pneumatic—Air is added until recommended tire pressure level is reached.

(NOTE: Pneumatic tires should be checked often with a low-pressure tire gauge.)

1. Bar type—Used primarily on tractors; has a very deep tread for extra traction

2. Ribbed—Aids in steering and turning; used on many front tractor wheels

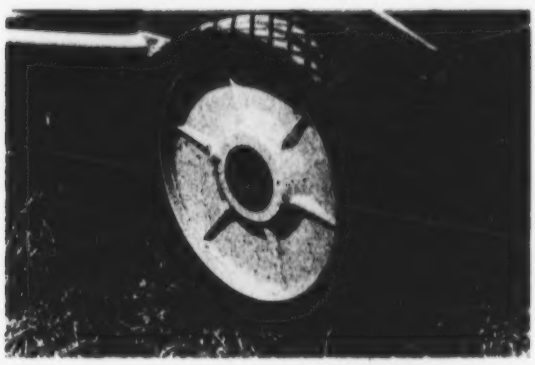
INFORMATION SHEET

3. Road—Used for driving on paved surfaces at higher speeds

4. Turf—Used primarily for driving on grass without leaving large ruts

5. Greens—Used for driving on golf course greens; leaves no track

B. Solid—No air is used. This type of tire is commonly used on attachment wheels and individual light power equipment wheels.



INFORMATION SHEET

VIII. Types of fuel used for landscaping equipment

A. Gasoline

1. Regular
2. Unleaded

B. Diesel

C. Liquified petroleum (L.P.)

(NOTE: You should always check to see what type of fuel is appropriate for the machine you are using.)

IX. Types of power take-off (PTO) drives that may be used on tractors

A. Hydraulic

B. Hydrostatic

(NOTE: Both of these use liquids under pressure to transmit power from the engine to operate attachments.

X. Chemicals that may be applied with a sprayer

(NOTE: Fertilizers and pesticides are available in several forms but only the liquid form can be used in sprayers. Dry chemicals are commonly applied with drop or rotary spreaders.)

A. Liquid fertilizers—Supply plants with essential plant-food elements

B. Liquid pesticides—Kill or control pests

1. Insecticides—Control insects
2. Herbicides—Control undesirable plants (weeds)
3. Fungicides—Control fungus diseases

XI. Spray drift and factors affecting it

A. Spray drift is the portion of the spray material that moves outside of the target area.

B. It can be either liquid or vapor (gas).

C. Drifting chemical could cause damage to susceptible, desirable species, or it could cause harmful contamination of air, water, soil, people, or animals.

INFORMATION SHEET

D. If the chemical leaves the target area, effectiveness within the target area is reduced.

E. Several factors affect the amount of drift.

Factor	Less Drift	More Drift
1. Droplet fall rate		
Droplet size	larger	smaller
Pressure	lower	higher
Orifice size	larger	smaller
Humidity	higher	lower
2. Wind speed	lower	higher
3. Release height	lower	higher
4. Air stability	less	more (inversion)
5. Size of treated area	smaller	larger

Maintenance Calendar for Bentgrass Putting Green, Oklahoma State University Extension Service.

XII. Pesticide safety tips

A. Read the label before each use, and follow the directions and precautions printed on it.

B. Identify the pest and determine if control is needed. Select the right pesticide for the crop, animal, or site and the associated pest problem.

C. Pesticides that require special protective clothing or equipment should be used only by trained, experienced applicators.

D. Store pesticides under lock in acceptable areas in the original container with proper labels affixed. Store feed or seed separate from pesticides. Keep herbicides separate from other types of pesticides to prevent contamination.

E. Never transfer a pesticide to a container that would attract children, such as a food or soft drink container. Keep pesticides in their original labeled container.

F. Check the expiration date on the pesticide label. Do not use outdated chemicals.

INFORMATION SHEET

G. Do not save or reuse empty pesticide containers. Dispose of containers promptly as follows:

1. Do not puncture or burn pressurized containers.
2. Rinse empty containers that hold liquid pesticides three times before disposal.

   (NOTE: The rinse water must be disposed of in a proper manner.)
3. Crush or puncture metal and plastic containers and break glass containers and take them to a state-approved sanitary landfill.

H. Check your application equipment for leaks and clogged lines, nozzles, and strainers.

I. Calibrate your equipment frequently for proper output using water.

J. Check gloves, respirator, and other protective clothing for holes and cleanliness before each use. Check respirator for a clean filter and good fit.

K. Make sure people have been warned and livestock and pets that may be exposed have been removed from the treated area.

L. Do not apply more pesticide than the label recommends.

M. When opening a container of liquid pesticide, keep your face away from and to one side of the cap or lid.

N. Mix or prepare dusts or sprays outdoors or in a well ventilated room.

O. Never smoke, eat, or drink while handling a pesticide. After finishing the work, wash exposed skin surfaces with soap and water.

P. If you spill pesticide on your skin or clothing, contact your supervisor, remove the contaminated clothing quickly, and wash the exposed skin surfaces with soap and water. Launder the clothing before wearing again.

Q. If pesticide gets into your eyes, contact your supervisor, flush the eyes with water for 10 minutes, and get medical attention.

R. If you swallow or splash pesticide in your mouth, contact your supervisor and check the label to see if vomiting should be induced.

INFORMATION SHEET

S. If you become ill during or shortly after using a pesticide, contact your supervisor and call a physician or poison control center immediately. Read them the names of the active chemical ingredients from the label on the container. Follow their instructions for first-aid treatment. If you go to a physician or control center for treatment, take the label with you or as much information as possible about the pesticide, such as the names of the active ingredients, antidote statements, or statement of practical treatment.

T. Check the label for recommended time intervals between the date of application and re-entry or harvest. If no re-entry time is given on the label, keep people, pets, etc. out of treated areas until sprays have dried and dusts have settled.

U. It is a violation of law to misuse any pesticide (use in a manner inconsistent with its labeling).

Pesticide safety tips information from *Maintenance Calendar for Bentgrass Putting Greens*, Oklahoma State University Extension Service.

XIII. Types of pesticide exposures

A. Dermal — Through the skin

(NOTE: Different parts of the body absorb the pesticide at different rates. The facial area absorbs 3-4 times faster than the hand or arm area.)

B. Oral — Through the mouth

C. Inhalation — Through the mouth or nose into the lungs

(NOTE: Exposure to pesticides can make you ill, and some pesticides are so poisonous that they can kill you. There are also some pesticides that seem less harmful so the applicator may not be as cautious around them. However, over a length of time, repeated exposures can build up in the applicator's body and cause serious illness or irreversible damage.)

XIV. Essentials of effective spraying

A. Correct timing of application

B. Proper chemicals and rates

C. Proper equipment used correctly

INFORMATION SHEET

XV. Basic types of sprayers

A. Large boom (hydraulic or manual)

B. Hand held

C. Backpack

XVI. Parts of a sprayer (Transparency 1)

(NOTE: Most sprayers used today are the hydraulic type in which the spray pressure is built up by direct action of the pump on the spray mixture.)

A. Antisiphon device — Installed between the domestic water source and the sprayer to prevent chemicals from being siphoned back from the sprayer into the water source, thereby contaminating it

B. Tank — Holds the chemical solution to be sprayed

C. Agitator — Keeps the liquids in the tank properly mixed

D. Pump — Raises, moves, and compresses liquids from tank to hoses

E. Hoses — Convey liquid through sprayer

INFORMATION SHEET

F. Strainers — Catch solid debris while liquid passes through

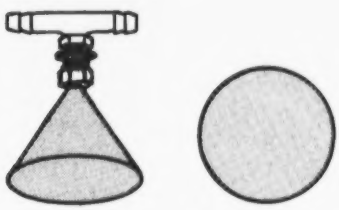
G. Valves — Regulate the flow of liquid through sprayer

H. Nozzles — Turn liquid leaving sprayer into droplets in a specific pattern and size

I. Boom — Contains nozzles a specificed distance apart to cover a large area

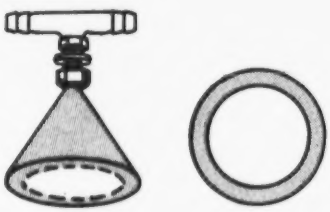
XVII. Basic nozzle spray patterns

A. Solid cone



FRONT VIEW TOP VIEW

B. Hollow cone



FRONT VIEW TOP VIEW

C. Flat (fan)

FRONT VIEW SIDE VIEW TOP VIEW

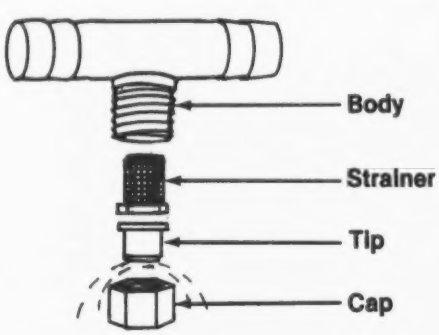
XVIII. Basic parts of a nozzle

A. Body

B. Strainer

C. Tip

D. Cap



INFORMATION SHEET

XIX. Care and storage of a sprayer

A. Daily cleaning

1. Be sure to clean the sprayer according to federal regulations in an area where the pesticide residue rinsed out will not contaminate the environment.

2. Rinse out the tank and run one half tank full of water through the nozzles to rinse the system. Repeat this step.

3. Clean nozzle tips and screens by removing them and using either kerosene or a detergent solution and a soft brush. Replace the nozzles.

4. Use about a half tank full of detergent and water solution to agitate in the tank about 30 minutes; then flush through the nozzles.

5. If an organic phosphorous insecticide such as 2, 4-D (check the label) was used, these additional steps must be followed. If this type of material was not used, move on to step 6.

   a. Add one pint of ammonia for each 25 gallons of water in one half tank full of water.

   b. Agitate for about 5 minutes and flush a small amount through the sprayer. Keep the rest of the solution in the sprayer overnight.

   c. In the morning flush out the ammonia solution through the sprayer.

6. Hose out the tank with clean water one last time and run half a tank full through the sprayer.

   (NOTE: Separate sprayers should be used for herbicides and insecticides.)

B. Storage of sprayer for winter

1. Remove nozzle tips, strainers, and screens, and store in light oil.

2. Store sprayer in a clean dry area.

3. Keep pump from freezing.

XX. Purpose of calibration — To determine the volume of liquid sprayed per acre under specific conditions so that the proper amount of chemical can be applied.

INFORMATION SHEET

XXI. Preparing a sprayer for calibration

A. Make sure the sprayer has been cleaned according to the proper procedure. Flush the unit with plenty of clean water.

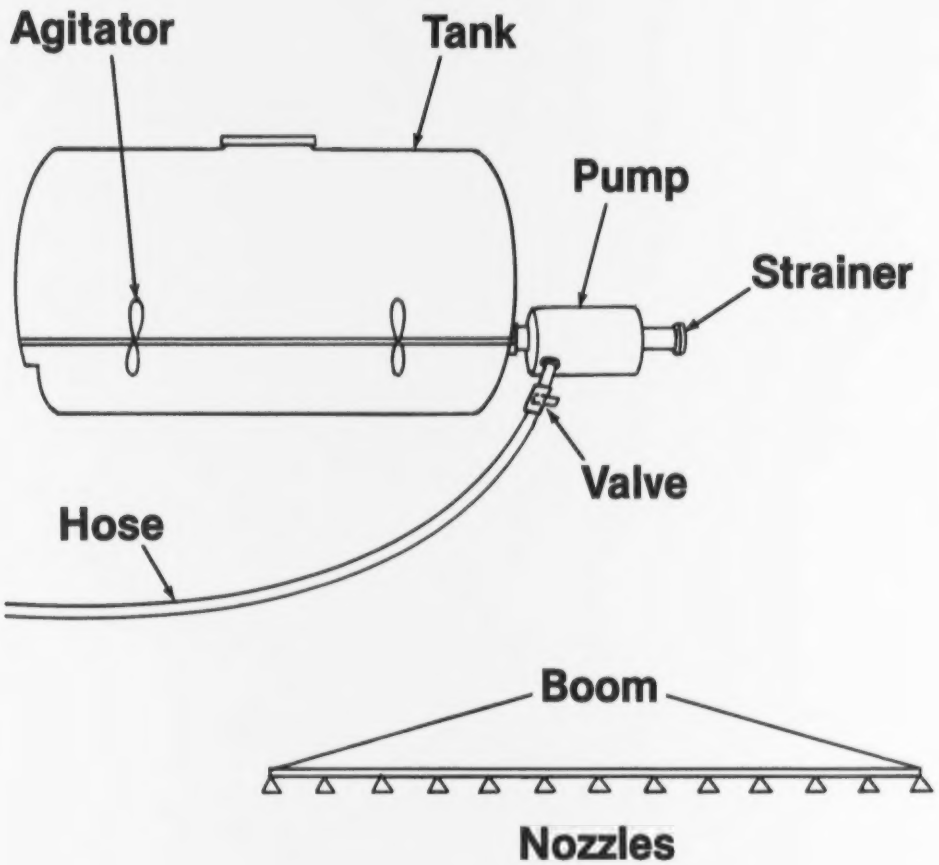
B. Check all the hoses and connections for leaks.

C. Check to see if the sprayer unit is working properly using water to test.

D. Select the proper pressure for the conditions with the tractor unit (or truckster) running.

E. Plan to calibrate the sprayer under conditions similar to those under which it will be used.

Parts of a Sprayer



EQUIPMENT
UNIT II

HANDOUT #1 — WEIGHTS AND MEASURES

FLUIDS

English Measure	English to Metric Conversion
⅛ fl oz = 1 tsp	1 tbs = 15 ml = 15 cc
½ fl oz = 1 tbs = 3 tsp	1 c = 240 ml
1 fl oz = 2 tbs = ⅛ c	16 fl oz = 0.48 L
8 fl oz = 1 c = ½ pt	1 gal = 3.8 L
16 fl oz = 2 c = 1 pt	1 gal = 8.3 lb = 3,764.9 g
32 fl oz = 4 c = 1 qt	
128 fl oz = 16 c = 1 gal	

LENGTHS

English Measure	English to Metric Conversion
1 ft = 12 in	1 in = 25.4 mm = 2.54 cm
1 yd = 3 ft	1 ft = 0.3 m = 30 cm
1 mi = 1760 yd = 5280 ft	1 yd = 0.91 m
1 r = 16.5 ft	1 mi = 1.6 km = 1600 m

AREAS

English Measure	English to Metric Conversion
1 sq ft = 144 sq in	1 sq in = 6.45 sq cm
1 sq yd = 9 sq ft	1 sq ft = 929 sq cm
1 A = 4840 sq yd = 43560 sq ft	1 sq yd = 0.836 sq m
	1 A = 0.4 ha = 4046.24 sq m

WEIGHTS

English Measure	English to Metric Conversion
16 oz = 1 lb	1 oz = 28.35 g
1 ton = 2000 lb	1 lb = 453.6 g
1 long ton = 2240 lb	1 ton = 907.2 kg
	1 long ton = 1016 kg

EQUIPMENT
UNIT II

HANDOUT #2 — APPROXIMATE CONVERSIONS FROM U.S. TO METRIC OR METRIC TO U.S.

When You Know:	You Can Find:	If You Multiply By:
Length		
inches	millimeters	25
feet	centimeters	30
yards	meters	0.9
miles	kilometers	1.6
meters	yards	1.1
kilometers	miles	0.6
Area		
square inches	square centimeters	6.5
square feet	square meters	0.09
square yards	square meters	0.8
square miles	square kilometers	2.6
square centimeters	square inches	0.16
square meters	square yards	1.2
square kilometers	square miles	0.4
Liquid Volume		
ounces	milliliters	30
pints	liters	0.47
quarts	liters	0.95
gallons	liters	3.8
liters	pints	2.1
liters	quarts	1.06
liters	gallons	0.26
Weight		
ounces	grams	28
pounds	kilograms	0.45
short tons	metric tons	0.9
grams	ounces	0.035
kilograms	pounds	2.2
Temperature		
degrees Fahrenheit	degrees Celsius (centigrade)	5/9 (after subtracting 32)
degrees Celsius	degrees Fahrenheit	9/5 (then add 32)

EQUIPMENT
UNIT II

ASSIGNMENT SHEET #1 — CALIBRATE A SPRAYER USING THE ACRE METHOD

NAME _____ SCORE _____

Directions: Use the following directions to solve the problems assigned.

1. Prepare sprayer.
2. Check nozzle for correct pattern and uniformity of output.
3. Determine effective boom width in feet. For broadcast spraying this is the length of boom plus 1½ feet.
4. Calculate how far the sprayer must travel to cover 1 acre with this formula.

$$\frac{43{,}560 \text{ (sq ft/A)}}{\text{effective boom width}} = \text{How far sprayer has to travel to cover one acre}$$

5. Measure and mark the distance calculated above on the field to be used.
6. Fill the sprayer tank with water to a depth which can be measured but not full.
7. Operate sprayer over measured distance.
8. Refill the tank to the original level and measure the amount of water used. This is the amount of water necessary to spray one acre at the speed and pressure and with the nozzles used.
9. Repeat the process as a check. The pressure, speed, and nozzles must *not* be changed or this will alter the result.

   (NOTE: To convert the previous calculations to 1000 sq. ft., divide the amount to spray one acre by 43.56.)

PROBLEMS:

1. If the effective boom width is 30 feet, how far must the sprayer travel before one square acre is sprayed?_____
2. If it takes 20 gallons of solution to spray one acre, how many acres will a tank which holds 300 gallons spray?_____
3. If you are to apply two gallons of pesticide concentrate per acre, and you want to spray four acres, how much pesticide must be added to the tank?_____

EQUIPMENT
UNIT II

ASSIGNMENT SHEET #2 — CALIBRATE A SPRAYER USING THE 1000 SQ. FT. METHOD

NAME _____ SCORE _____

Directions: Use the following directions to solve the problems assigned.

1. Fill hand or backpack sprayer with water to a predetermined mark on tank.
2. Measure 1000 sq. ft. of area to be sprayed.
3. Spray the area completely and uniformly, using the pressure and spraying speed normally used whenever spraying. *COMPLETE COVERAGE IS CRITICAL!*
4. Refill tank to mark on tank, noting amount needed to fill.
5. This is the amount of pesticide solution needed to treat 1000 sq. ft.

PROBLEMS:

1. If it takes 1½ gallons of solution to spray 1000 sq. ft., how much solution is needed to spray 4000 sq. ft.? _____
2. If the directions on a broadleaf herbicide tells you to use 2 oz. of the particular pesticide per 1000 sq. ft. of lawn area, and you need to spray 2000 sq. ft. of lawn, using 1½ gallons of solution per 1000 sq. ft., how much pesticide and how much water do you add to the tank?

   _____ pesticide

   _____ water

EQUIPMENT
UNIT II

ASSIGNMENT SHEET #3 — CALIBRATE A SPRAYER USING THE NOMOGRAPH METHOD

NAME _____ SCORE _____

Directions: Use the following directions and examples to solve for the unknown factor in the given situations.

1. Using the sprayer calibration nomograph on the next page and a straight edge, draw one line through the left hand scale for the ground speed (in miles per hour) and the nozzles spacing in inches and intersect the pivot line.

2. Draw another line starting at the point of intersection of the first line and the pivot line and connect the application rate in gallons per acre with the right scale representing the nozzle size.

3. By using this nomograph you can solve for any unknown as long as the other three factors are known.

Example A: Broadcast sprayer with 15-inch nozzle spacings
Nozzle output = 30 oz/min
How many miles per hour required to put on 15 gal per acre?_____

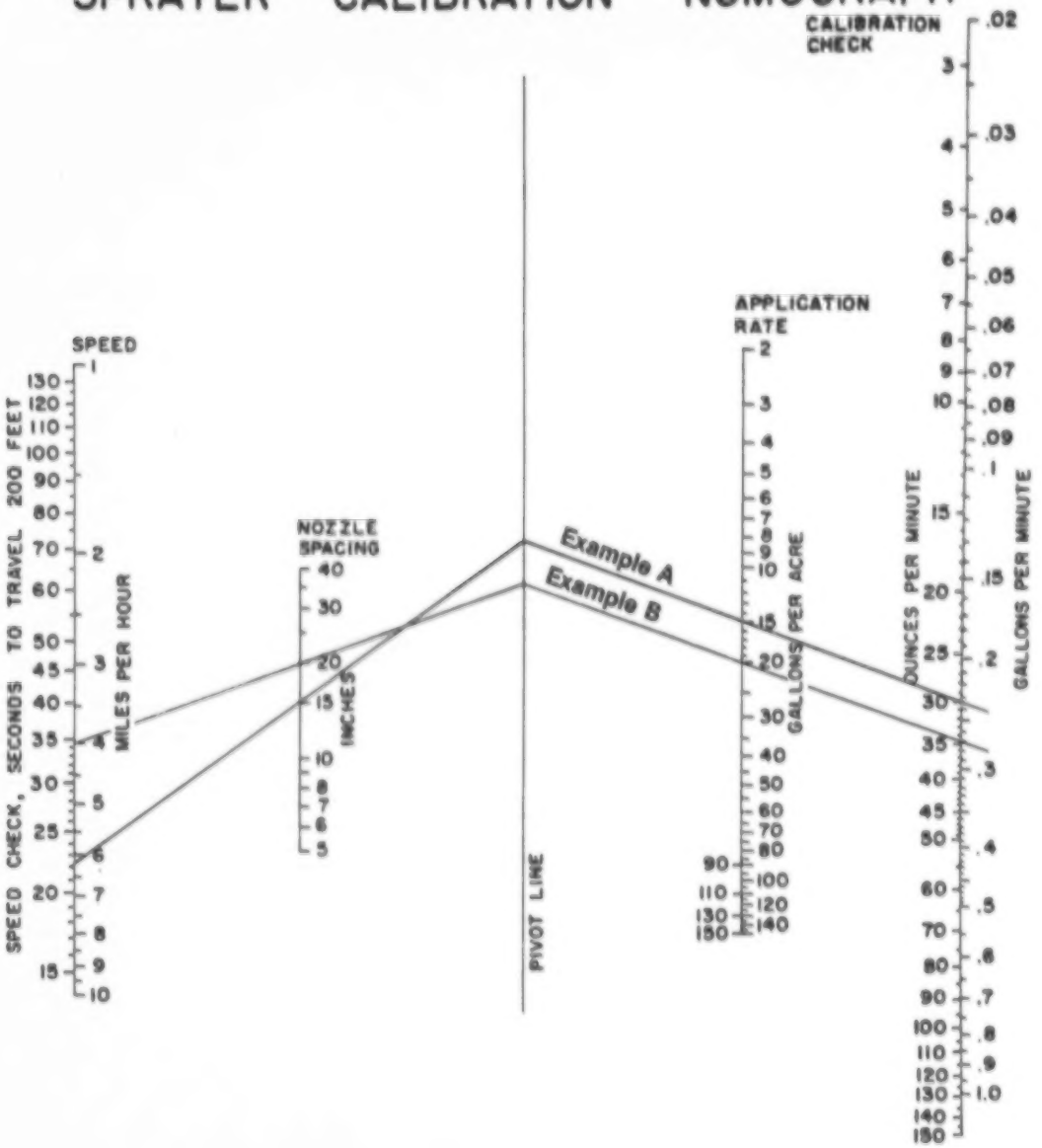
Solution A: On the nomograph on the next page, the first line should start at 30 oz/min on the right hand scale and pass through 15 gal/acre on the application rate scale until it intersects the pivot line. The second line should connect the point of intersection of the first line and the pivot line and pass through 15 in. on the nozzle spacing scale until it intersects the left hand or speed scale. The correct answer is approximately 6.25 miles per hour or 22 seconds to travel 200 feet.

Example B: Sprayer ground speed is 4 mph
Nozzle spacing is 20 inches
Desired application rate is 20 gal/acre

Solution B: Using a straight edge, draw a line from 4 mph on "speed line" through 20 inches on "nozzle spacing line" and locate point where line intercepts "pivot line." Now draw a line through intercept point on "pivot line" and through 20 gal./acre on "application rate line" and locate point where line intercepts "calibration check line." Read either 34 oz/min or 0.27 gal./min. Select nozzle size to give 0.27 gal./min at desired pressure. Adjust pressure regulator to give a flow rate of 35 ounces/minute from each nozzle.

ASSIGNMENT SHEET #3

SPRAYER CALIBRATION NOMOGRAPH



Courtesy of Oklahoma State University Extension Service

ASSIGNMENT SHEET #3

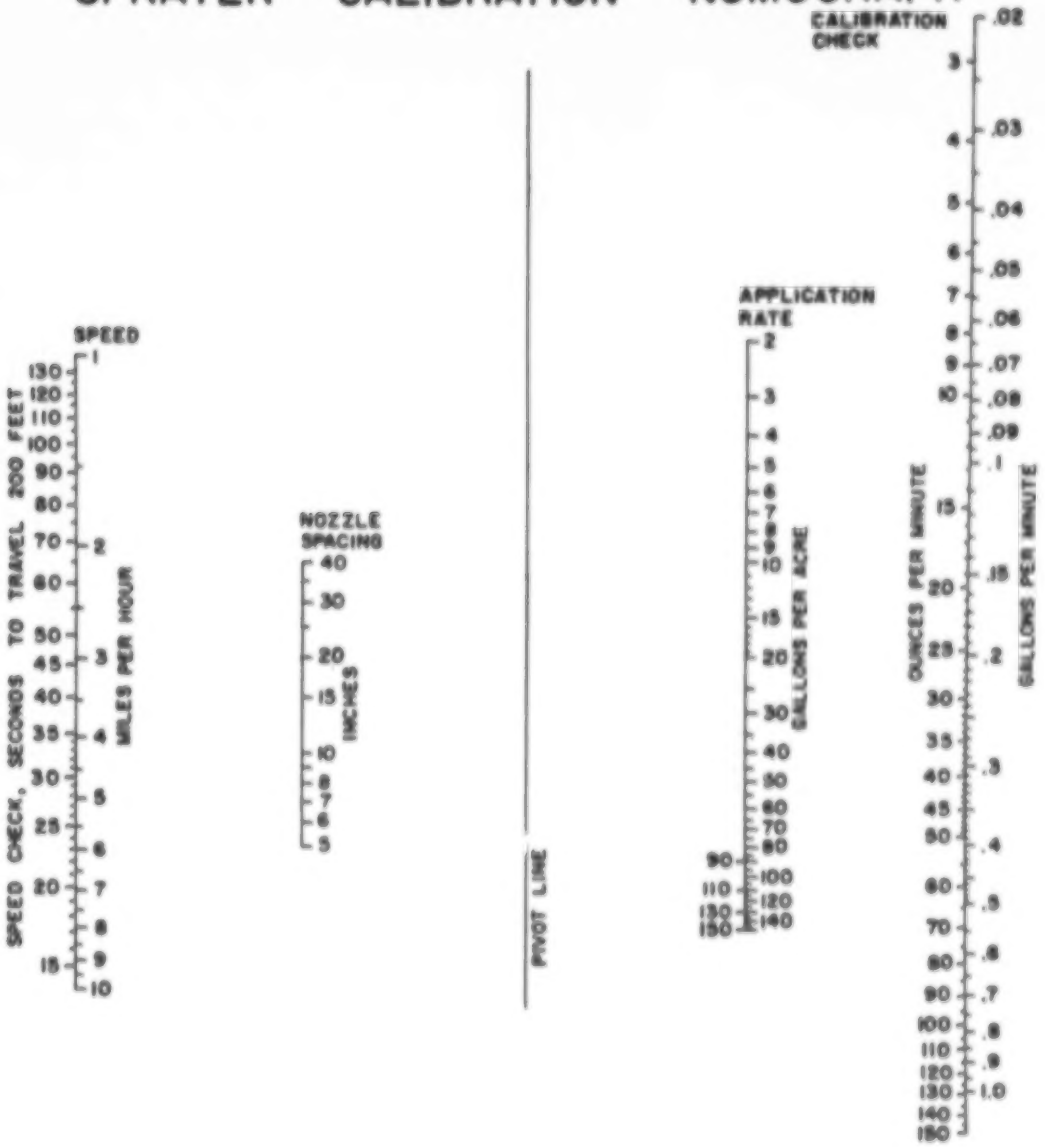
PROBLEMS: Use blank nomograph on next page to solve these problems.

1. Nozzle spacings = 30 inch
   Nozzle output = 30 oz/min
   Gallons/acre output = 15 gallons/acre
   Miles/hour required = _____

2. Nozzle spacings = 20 inch
   Nozzle output = 25 oz/min
   Gallons/acre output = _____
   Miles/hour = 5 mph

ASSIGNMENT SHEET #3

SPRAYER CALIBRATION NOMOGRAPH



Courtesy of Oklahoma State University Extension Service

EQUIPMENT
UNIT II

ASSIGNMENT SHEET #4 — EXPLAIN HOW TO CLEAN A SPRAYER

NAME _____ SCORE _____

Directions: Answer the following questions based on your experience in cleaning sprayers and the information covered in the information sheet.

1. Explain how to clean a sprayer after spraying a phenoxy herbicide. _____

2. Explain the proper method of sprayer decontamination and cleanup for other herbicides. _____

EQUIPMENT
UNIT II

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1. $\frac{43,560 \text{ sq ft}}{30 \text{ lin ft boom width}} = 1,452 \text{ lin ft.}$

2. $\frac{300 \text{ gal}}{20 \text{ gal/A}} = 15 \text{ acres for 1 tank}$

3. 4 acres × 2 gal per acre = 8 gallons of pesticide

Assignment Sheet #2

1. 1½ gal × 4000 sq. ft. = 6 gallons of spray needed
2. 2 oz. pesticide × 2000 sq. ft. = 4 oz. pesticide
   1½ gal solution/1000 sq. ft. × 2000 sq. ft. =3 gallons of water

Assignment Sheet #3

1. Approximately 3.25 mph or 200 feet in 44 seconds
2. 12 gal/acre

Assignment Sheet #4— Evaluated to the satisfaction of the instructor

EQUIPMENT
UNIT II

JOB SHEET #1 — OPERATE A MANUAL TRANSMISSION TRACTOR

A. Equipment — Manual transmission tractor

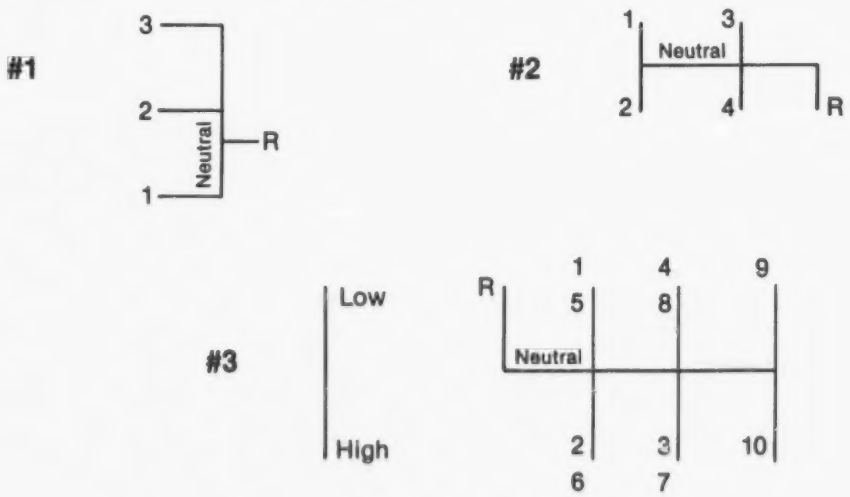
B. Procedure

(NOTE: Make sure you meet your state licensing requirements before operating any vehicle.)

(CAUTION: Never start an engine in a closed building unless adequate ventilation is provided.)

1. Check to make sure tractor has been serviced properly.
2. Determine the gearshift pattern for your tractor.

FIGURE 1 — Common gearshift patterns



3. Open fuel shut-off valve.
4. Get on seat and apply brakes.
5. Disengage main clutch and put in neutral.
6. Put speed range (if equipped) in neutral.
7. Put power-take-off (PTO) engaging lever in neutral or off position.

JOB SHEET #1

8. Set choke on appropriate setting, usually "full on" if engine is cold (for gasoline engine).

FIGURE 2

9. Set throttle about half way.
10. Turn on ignition switch to start the engine.
11. To start tractor movement, disengage parking brake latch.
12. Put transmission in drive by disengaging (pressing down) the clutch, and selecting the proper gear and the proper speed range (high and low).
13. Slowly let out (engage) the clutch.
14. To stop tractor movement, reduce throttle, disengage clutch, and apply brakes slowly.

    (NOTE: Make sure both brake pedals (left and right) are locked together. Prepare to stop far in advance and avoid sudden stops.)
15. After tractor has stopped, place transmission in neutral.
16. Disengage clutch and place gear in reverse.
17. Back up the tractor, watching carefully behind the tractor.
18. Set parking brake.
19. Disengage PTO.
20. Lower mounted implements to ground.
21. Place transmission in first gear, reverse, or parking if so equipped.

JOB SHEET #1

22. Turn off ignition.

23. Disengage clutch after engine stops.

24. Remove key.

EQUIPMENT
UNIT II

JOB SHEET #2 — LOAD AND SECURE EQUIPMENT

A. Tools and materials

1. Tractor
2. Trailer
3. Small equipment such as push mower, wheelbarrow, lawn roller, etc.
4. Self-propelled equipment such as riding mower, tractor, trencher, etc.
5. Chocks
6. Chain
7. Boomer — Device used to tighten down and chain load (can be obtained from your instructor)

B. Procedure

1. To load self-propelled equipment onto a trailer
   a. Make sure ramps are securely attached to trailer.
   b. Make sure blades on equipment are disengaged.
   c. Load implement onto trailer placing bulk of load over trailer wheels.
   d. Shut off engine. Make sure drive gear is engaged.
   e. Chock the wheels.

FIGURE 1

JOB SHEET #2

f. Attach chain and boomer tightly to secure tie down location on tractor.

FIGURE 2

g. Wrap loose loop of chain around boomer handle.

h. Load ramps.

2. To load smaller equipment onto a trailer

a. Get help.

b. Load equipment toward front of trailer.

FIGURE 3

JOB SHEET #2

c. Tie down equipment with heavy rope if traveling short distance, or with chain if traveling long distance.

FIGURE 4

EQUIPMENT
UNIT II

JOB SHEET #3 — SERVICE AND MAINTAIN A LAWN TRACTOR

A. Tools and materials

1. Lawn tractor
2. Clean shop towels or rags
3. Crankcase oil
4. Oil for oil filters
5. Dry-filter elements
6. Fuel—diesel, gasoline, or L.P. (whichever is appropriate)
7. Water (for battery)
8. Transmission fluid
9. Hydraulic fluid
10. Tire gauge
11. Wrenches (sizes will depend on the size of the tractor)
12. Other small tools as needed depending on the tractor (Check with your instructor.)

B. Procedure: Service the following items.

1. Crankcase — Check before each use and at refueling.
   a. Stop the engine after placing the tractor on level ground.
   b. Clean area around dipstick and remove the cap or dipstick.

FIGURE 1

JOB SHEET #3

c. Add oil if it is low in the filler hole or on the dipstick, and replace cap or dipstick. If it is not low, simply replace the cap or dipstick.

2. Air cleaner — Check every 10 hours or more often if used under very dusty or dirty conditions. Check operator's manual for instructions for cleaning.

3. Battery — Check about every 25 hours of use.

   a. Check electrolyte level of battery by removing the caps. If level is below the correct level, add clean water to cover the plates to the bottom of the filler tube.

      (NOTE: This is not necessary for a maintenance-free battery.)

   b. Clean battery cables, terminals, and supports.

      FIGURE 2

   c. Tighten battery connections.

4. Cooling systems

   a. Air-cooled engines

      1) Lift hood or remove side panels.

      2) Clean flywheel air screen.

      3) Clean engine cover.

      4) Remove cover and baffles.

      5) Clean cooling fins of all dirt, grease, and debris.

      6) Replace baffle, cover, and side panels.

JOB SHEET #3

b. Liquid-cooled engines

1) Check the radiator core for dirt and debris.

2) Clean thoroughly if required.

3) Make sure radiator is cool.

4) Loosen the radiator cap to the stop to relieve any excess pressure.

5) Remove cap and check coolant level.

6) Add water or antifreeze solution if the coolant level is more than 1 ½ to 2" below the top of the filler neck.

FIGURE 3

7) Replace radiator cap and tighten.

5. Fuel tank

a. Remove fuel tank cap and check fuel level.

b. Make sure engine is cool.

JOB SHEET #3

c. Add fuel if needed.

(CAUTION: Make sure you are adding the correct fuel.)

FIGURE 4

d. Check the fuel tank cap for cleanliness and make sure the breather hole is not plugged.

e. Open fuel line shut-off valve and look for leaks in the fuel line connections.

6. Miscellaneous items

a. Manual transmission — Check every 300 hours of use.

1) Check belts and chains for proper tension and alignment.

2) Check gear case for leaks.

3) Check fluid level on dipstick. Add transmission fluid if necessary.

b. Hydrostatic (automatic) transmission — Check every 25 hours.

1) Check fluid level.

2) Check fan and cooling fins.

3) Look for fluid leaks.

c. Hydraulic system — Check every 50 hours of use.

1) Start engine on level ground.

2) Engage all control levers on hydraulic system.

JOB SHEET #3

3) Remove filler plug or cap, check fluid level, and add fluid if needed.

4) For lawn and garden tractors check while engine is off (not running).

d. Chassis — Check weekly for

1) Leaking grease or oil seals

2) Loose nuts, bent brackets, and bent frame

3) Loose or worn belts, chains, and linkage

4) Loose wheel lugs, bent rims, misalignment

5) Broken or bent headlights

6) Proper lubrication

e. Tires — Check daily for

1) Over or under inflation

2) Tread wear

EQUIPMENT
UNIT II

JOB SHEET #4 — CALIBRATE AND USE A SPRAYER

A. Tools and materials

1. Spray unit
2. Spraying solution or water
3. Tape measure

B. Procedure

1. Fill tank ¾ full of water.
2. Mark water level on tank.
3. Measure effective boom width.

FIGURE 1

4. Calculate distance you need to spray to spray one square acre.

JOB SHEET #4

5. Set pressure at pump to 30-40 PSI. Note pressure used.

   FIGURE 2

6. Check nozzles for good condition and correct spray patterns.
7. Before spraying, determine and note a comfortable sprayer ground speed.
8. Check for drift.

   (NOTE: If there is excessive drift, you may want to decrease the pressure, lower the boom, or change the nozzle size. Check with your instructor for the appropriate action to take.)

9. Begin spraying at first mark of measured distance.
10. Spray measured length, shutting off boom valve at second mark.
11. Fill tank back up to original water level, measuring the amount needed. This is the amount of spray needed to spray one acre.
12. Repeat above steps to double check calibration.
13. Return sprayer to storage area and explain to instructor how to clean the rig.

EQUIPMENT
UNIT II

PRACTICAL TEST
JOB SHEET #1 — OPERATE A MANUAL TRANSMISSION TRACTOR

STUDENT'S NAME _____ DATE _____

EVALUATOR'S NAME _____ ATTEMPT NO. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

(EVALUATOR NOTE: Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.)

The student:	YES	NO
1. Checked out proper tools and materials.		
2. Tractor not started in a closed building.		
3. Student made sure tractor was serviced.		
4. Opened fuel shut-off valve.		
5. Disengaged clutch and put in neutral.		
6. Put speed range in neutral.		
7. Put PTO engaging lever in neutral.		
8. Set choke and throttle correctly.		
9. Started engine.		
10. Disengaged parking brake.		
11. Put transmission in drive.		
12. Let out clutch slowly.		
13. Reduced throttle and applied brakes slowly.		
14. Placed transmission in reverse.		
15. Backed up tractor.		
16. Set parking brake.		
17. Disengaged PTO.		
18. Lowered implements to ground.		
19. Placed transmission in first, reverse, or parking gear.		
20. Turned off ignition and removed key.		
21. Checked in/put away tools and materials.		
22. Practiced safety rules throughout procedure.		

EVALUATOR'S COMMENTS: _____

_____

JOB SHEET #1 PRACTICAL TEST

PRODUCT EVALUATION

(EVALUATOR NOTE: Rate the student on the following criteria by circling the appropriate numbers. Each item must be rated at least a "3" for mastery to be demonstrated. (See performance evaluation key below.) If the student is unable to demonstrate mastery, student materials should be reviewed and another product must be submitted for evaluation.)

Criteria:				
Starts were smooth—no jerks	4	3	2	1
Driving was straight	4	3	2	1
Curves were turned correctly	4	3	2	1
Stops were smooth—no jerks or sudden stops	4	3	2	1
Correct speed was used	4	3	2	1
Correct gears were used	4	3	2	1

EVALUATOR'S COMMENTS: _____

_____

PERFORMANCE EVALUATION KEY
4 — Skilled — Can perform job with no additional training. 3 — Moderately skilled — Has performed job during training program; limited additional training may be required. 2 — Limited skill — Has performed job during training program; additional training is required to develop skill. 1 — Unskilled — Is familiar with process, but is unable to perform job.

(EVALUATOR NOTE: If an average score is needed to coincide with a competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria.)

EQUIPMENT
UNIT II

PRACTICAL TEST
JOB SHEET #2 — LOAD AND SECURE EQUIPMENT

STUDENT'S NAME _____ DATE _____

EVALUATOR'S NAME _____ ATTEMPT NO. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

(EVALUATOR NOTE: Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.)

The student:	YES	NO
1. Checked out proper tools and materials.	_____	_____
2. Made sure ramps were securely attached.	_____	_____
3. Made sure blades were disengaged.	_____	_____
4. Loaded implement with bulk of load over trailer wheels.	_____	_____
5. Shut off engine w/drive gear engaged.	_____	_____
6. Attached chain and boomer to tie down equipment properly.	_____	_____
7. Loaded ramps.	_____	_____
8. Got help to load small equipment.	_____	_____
9. Loaded equipment toward front of trailer.	_____	_____
10. Tied down equipment properly.	_____	_____
11. Practiced safety rules throughout procedure.	_____	_____

EVALUATOR'S COMMENTS: _____

_____

JOB SHEET #2 PRACTICAL TEST

PRODUCT EVALUATION

(EVALUATOR NOTE: Rate the student on the following criteria by circling the appropriate numbers. Each item must be rated at least a "3" for mastery to be demonstrated. (See performance evaluation key below.) If the student is unable to demonstrate mastery, student materials should be reviewed and another product must be submitted for evaluation.)

Criteria:

Self-propelled equipment was loaded and tied down properly	4	3	2	1
Small equipment was loaded and tied down properly	4	3	2	1

EVALUATOR'S COMMENTS: _____

_____

PERFORMANCE EVALUATION KEY
4 — Skilled — Can perform job with no additional training. 3 — Moderately skilled — Has performed job during training program; limited additional training may be required. 2 — Limited skill — Has performed job during training program; additional training is required to develop skill. 1 — Unskilled — Is familiar with process, but is unable to perform job.

(EVALUATOR NOTE: If an average score is needed to coincide with a competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria.)

EQUIPMENT
UNIT II

PRACTICAL TEST
JOB SHEET #3 — SERVICE AND MAINTAIN A LAWN TRACTOR

STUDENT'S NAME _____ DATE _____

EVALUATOR'S NAME _____ ATTEMPT NO. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

(EVALUATOR NOTE: Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.)

The student:	YES	NO
1. Checked out proper tools and materials.	_____	_____
2. Serviced and maintained crankcase.	_____	_____
3. Serviced and maintained air cleaner.	_____	_____
4. Serviced and maintained battery.	_____	_____
5. Serviced and maintained cooling system.	_____	_____
6. Serviced and maintained fuel tank.	_____	_____
7. Serviced and maintained transmission.	_____	_____
8. Serviced and maintained hydraulic system.	_____	_____
9. Serviced and maintained chassis.	_____	_____
10. Serviced and maintained tires.	_____	_____
11. Checked in/put away tools and materials.	_____	_____
12. Cleaned the work area.	_____	_____
13. Practiced safety rules throughout procedure.	_____	_____

EVALUATOR'S COMMENTS: _____

_____

JOB SHEET #3 PRACTICAL TEST

PRODUCT EVALUATION

(EVALUATOR NOTE: Rate the student on the following criteria by circling the appropriate numbers. Each item must be rated at least a "3" for mastery to be demonstrated. (See performance evaluation key below.) If the student is unable to demonstrate mastery, student materials should be reviewed and another product must be submitted for evaluation.)

Criteria:				
Crankcase has adequate oil	4	3	2	1
Air cleaner is clean	4	3	2	1
Battery is clean and at correct elec trolyte level	4	3	2	1
Cooling system is clean	4	3	2	1
Fuel tank is clean, full, and without leaks	4	3	2	1
Transmission and hydraulic system are clean, with adequate fluid, and no leaks	4	3	2	1
Chassis has no loose or broken parts and is properly lubricated	4	3	2	1
Tires are properly inflated with little wear	4	3	2	1

EVALUATOR'S COMMENTS: _____

_____

PERFORMANCE EVALUATION KEY
4 — Skilled — Can perform job with no additional training. 3 — Moderately skilled — Has performed job during training program; limited additional training may be required. 2 — Limited skill — Has performed job during training program; additional training is required to develop skill. 1 — Unskilled — Is familiar with process, but is unable to perform job.

(EVALUATOR NOTE: If an average score is needed to coincide with a competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria.)

EQUIPMENT
UNIT II

PRACTICAL TEST
JOB SHEET #4 — CALIBRATE AND USE A SPRAYER

STUDENT'S NAME _____ DATE _____

EVALUATOR'S NAME _____ ATTEMPT NO. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

(EVALUATOR NOTE: Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.)

The student:	YES	NO
1. Checked out proper tools and materials.	_____	_____
2. Properly filled and marked water level in tank.	_____	_____
3. Correctly calculated distance to spray and measured and marked.	_____	_____
4. Correctly measured effective boom width.	_____	_____
5. Properly set pressure of pump.	_____	_____
6. Determined comfortable ground speed.	_____	_____
7. Properly sprayed marked distance.	_____	_____
8. Properly measured amount of spray used.	_____	_____
9. Repeated steps for calibration check.	_____	_____
10. Explained proper method of sprayer decontamination and cleanup.	_____	_____
11. Checked in/put away tools and materials.	_____	_____
12. Cleaned the work area.	_____	_____
13. Practiced safety rules throughout procedure.	_____	_____
14. Provided satisfactory responses to questions asked.	_____	_____

EVALUATOR'S COMMENTS: _____

_____

JOB SHEET #4 PRACTICAL TEST

PRODUCT EVALUATION

(EVALUATOR NOTE: Rate the student on the following criteria by circling the appropriate numbers. Each item must be rated at least a "3" for mastery to be demonstrated. (See performance evaluation key below.) If the student is unable to demonstrate mastery, student materials should be reviewed and another product must be submitted for evaluation.)

Criteria:				
	4	3	2	1
Determined correct rate of spray application				
	4	3	2	1
Re-calibration duplicated first results				
	4	3	2	1
Proper knowledge of sprayer calibration shown				

EVALUATOR'S COMMENTS: _____

_____

PERFORMANCE EVALUATION KEY
4 — Skilled — Can perform job with no additional training. 3 — Moderately skilled — Has performed job during training program; limited additional training may be required. 2 — Limited skill — Has performed job during training program; additional training is required to develop skill. 1 — Unskilled — Is familiar with process, but is unable to perform job.

(EVALUATOR NOTE: If an average score is needed to coincide with a competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria.)

EQUIPMENT
UNIT II

TEST

NAME _____ SCORE _____

1. Match the terms on the right with the correct definitions.

_____a.	Operated or moved by means of water or other liquid in motion	1. Acre
_____b.	Long pipe or tubing with several nozzles used to apply chemicals over a wide area at one time	2. Acute toxicity
_____c.	Amount of chemical applied per acre	3. Antidote
_____d.	A substance that through its chemical action can kill or injure an organism	4. Application rate
_____e.	To accidentally poison desirable plants, animals, people, food, supplies, or the environment with harmful chemicals	5. Articulated equipment
_____f.	Direct or indirect contact with a harmful chemical	6. Boom
_____g.	To determine the application rate of a sprayer or spreader	7. Calibrate
_____h.	Supplementary mechanism enabling the engine power to be used to operate an attachment	8. Chronic toxicity
_____i.	A remedy to counteract the effects of poison	9. Contaminate
_____j.	A plant or animal that annoys or is harmful to humans	10. Exposure
_____k.	An area of land equal to 43,560 sq. ft.	11. Ground driven
_____l.	The gradual onset of chemical poisoning symptoms from frequent exposures over a long time to a harmful pesticide	12. Hydraulic
		13. Pest
		14. Pneumatic
		15. Poison
		16. Power take-off (PTO)
		17. Three-point hitch

TEST

2. Match the types of groundskeeping tractors with their correct descriptions.

_____a.	7 - 18 horsepower with a large variety of attachments	1. Riding lawn mover
_____b.	5 - 25 horsepower mounted with a mower attachment	2. Lawn tractor (small)
_____c.	18 - 80 horsepower or more with a large variety of attachments	3. Lawn and garden tractor (large)

3. Identify the two types of mowers.

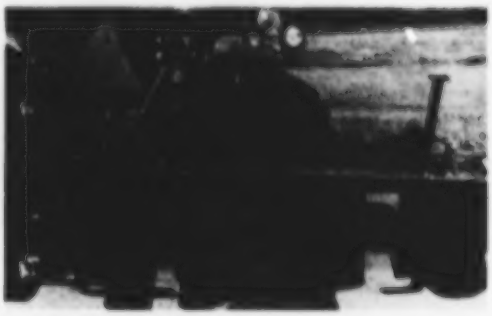
a. _____

b. _____

TEST

4. Identify the following attachments for mowers and tractors.

a. _____

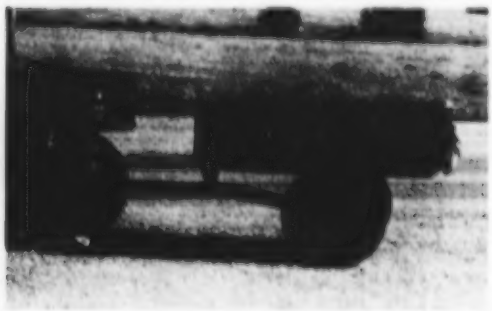


b. _____

c. _____

d. _____

e. _____



f. _____

TEST

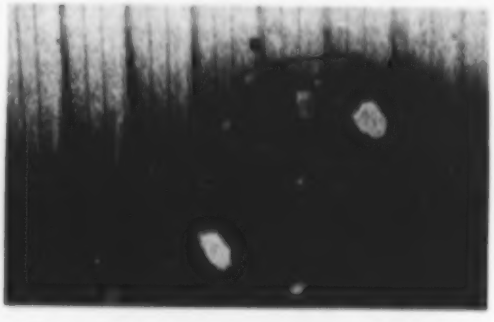
g. _____

h. _____

i. _____

j. _____

k. _____



l. _____

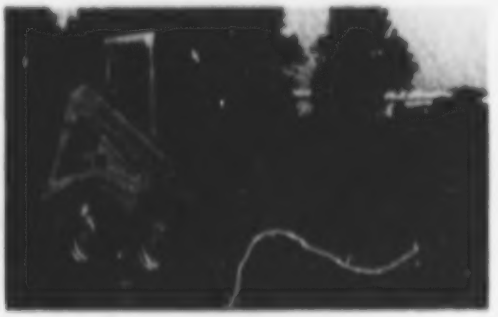
TEST

5. Identify these other types of equipment used in landscaping.

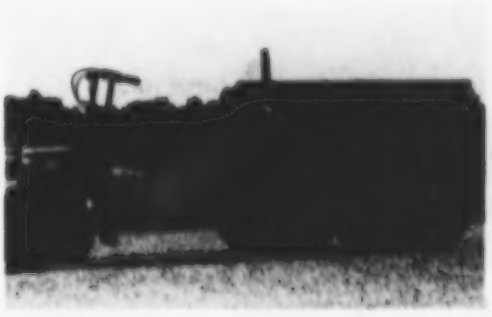
a. _____

b. _____

c. _____



d. _____



e. _____

f. _____

TEST

6. Select true statements about equipment safety by indicating with T (true) or F (false) if the statement is true or false.

_____a. It is not necessary to read the operator's manual before operating machinery such as a tractor.

_____b. Any kind of clothing is acceptable when operating a tractor.

_____c. Wear a respirator under very dusty conditions.

_____d. Wear safety glasses or goggles if needed for eye protection.

_____e. Be sure all guards and shields are in place before starting the engine.

_____f. Be alert for people or pets or hidden objects on the ground.

_____g. Speed up when operating on slopes.

_____h. You should always drive up a hill.

_____i. You should signal and slow down when turning.

_____j. It is acceptable to give rides on a tractor.

7. Distinguish among the basic types of tires used on landscaping equipment by placing the following letters next to the correct descriptions:

- B—Bar type
- G—Greens
- RI—Ribbed
- RO—Road
- S—Solid
- T—Turf

_____a. Used primarily for driving on grass without leaving large ruts

_____b. Used for driving on golf course areas; leaves no track

_____c. Aids in steering and turning; used on many front tractor wheels

_____d. Used for driving on paved surfaces at higher speeds

_____e. Used primarily on tractors; has a very deep tread for extra traction

8. List two types of fuel used for landscaping equipment.

a. _____

b. _____

TEST

9. List two types of power take-off (PTO) drives that may be used on tractors.

   a. _____

   b. _____

10. Match the chemicals that may be applied with a sprayer with the correct definitions.

_____a.	Control insects	1. Fertilizers
_____b.	Control fungus diseases	2. Fungicides
_____c.	Supply plants with essential plant food elements	3. Herbicides
_____d.	Control undesirable plants (weeds)	4. Insecticides
_____e.	Kill or control pests	5. Nematicides
		6. Pesticides

11. Complete the following statements concerning spray drift by circling the correct words.

    a. Spray drift is the portion of the spray material that moves (**inside, outside**) of the target area.

    b. Spray drift can be either liquid or (**solid, vapor**).

    c. High wind speeds cause (**less, more**) drift.

    d. A lower release height causes (**less, more**) drift.

    e. Larger droplets create (**less, more**) drift.

12. Select true statements about pesticide safety by indicating with T (true) or F (false) if the statement is true or false.

    _____a. You should always read the label and follow the directions.

    _____b. Pesticides should be stored under lock and key in the original container.

    _____c. Do not save or reuse empty pesticide containers.

    _____d. If you calibrate your equipment once, there is no need to do it again.

    _____e. It is not a violation of law to use any pesticide in a different way than described on the label.

TEST

_____f. It is acceptable to eat when handling a pesticide.

_____g. If pesticide gets into your eyes, flush the eyes with water for two minutes and get medical attention.

_____h. If you become ill during or shortly after using a pesticide, you are probably just tired and should not worry about calling a doctor.

_____i. Mix or prepare dusts or sprays outdoors or in a well-ventilated room.

_____j. Never transfer a pesticide to another container other than its original one.

13. Distinguish among the types of pesticide exposures by placing the following letters next to the correct descriptions:

- D—Dermal
- I—Inhalation
- O—Oral

_____a. Through the mouth

_____b. Through the skin

_____c. Through the mouth or nose into the lungs

14. Name the three essentials of effective spraying.

a. _____

b. _____

c. _____

15. Identify the basic types of sprayers shown.

a. _____

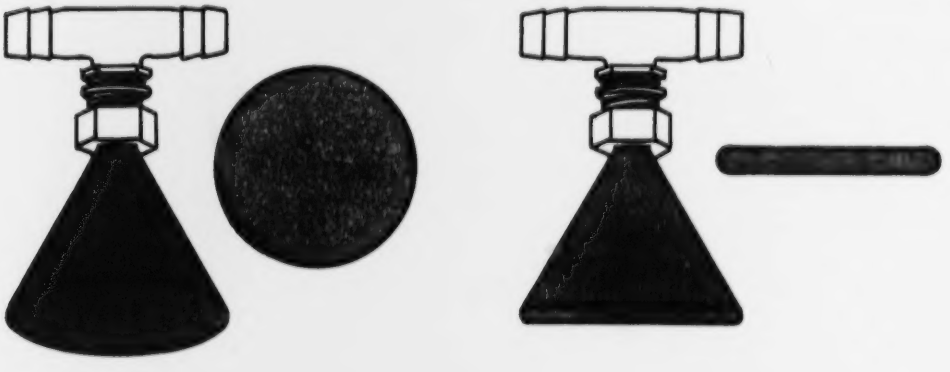
b. _____

TEST

16. Match the major parts of a sprayer with the correct descriptions.

_____a.	Holds the chemical solution to be sprayed	1. Agitator
_____b.	Raises, moves, and compresses liquids from tank to hoses	2. Antisiphon device
_____c.	Keeps the liquids in the tank properly mixed	3. Boom
_____d.	Convey liquid through sprayer	4. Hoses
_____e.	Catch solid debris while liquid passes through it	5. Nozzles
_____f.	Turn liquid leaving sprayer into droplets in a specific pattern and size	6. Pump
_____g.	Regulate the flow of liquid through sprayer	7. Strainers
_____h.	Contains nozzles a specified distance apart to cover a large area	8. Tank
		9. Valves

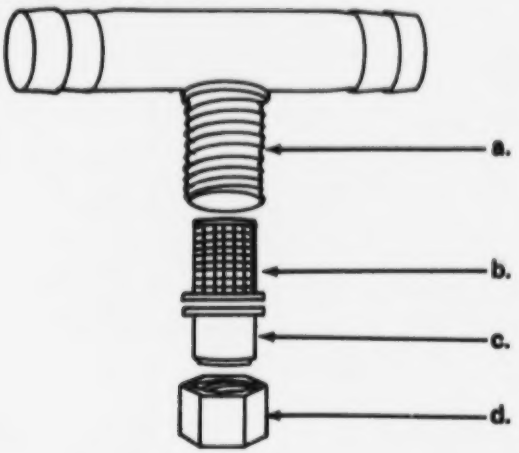
17. Identify the basic nozzle spray patterns shown.



a. _____ b. _____

TEST

18. Identify the basic parts of a nozzle.



a. _____ b. _____

c. _____ d. _____

19. Complete the following statements concerning the care and storage of a sprayer by correctly filling in the blanks.

a. Be sure to clean the sprayer in an area where _____

_____

b. Rinse out the tank and run one half tank full of _____ through the nozzles to rinse the system. Repeat this step.

c. Nozzle tips and screens should be cleaned with a brush and _____.

d. If a sprayer is used every day, how often should it be cleaned? _____

e. If an organic phosphorus insecticide such as 2, 4-D is used, _____ and water should next be used to clean the sprayer.

f. When storing a sprayer for the winter, the nozzle tips, strainers, and screens should be removed and stored in _____.

20. State the purpose of calibration. _____

_____

TEST

21. Name two things you should do in preparing a sprayer for calibration.

    a. _____

    b. _____

(NOTE: If the following activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

22. Calibrate a sprayer by the acre method. (Assignment Sheet #1)

23. Calibrate a sprayer by the 1000 sq. ft. method. (Assignment Sheet #2)

24. Calibrate a sprayer by the nomograph method. (Assignment Sheet #3)

25. Explain how to clean a sprayer. (Assignment Sheet #4)

26. Demonstrate the ability to:

    a. Operate a manual transmission tractor. (Job Sheet #1)

    b. Load and secure equipment. (Job Sheet #2)

    c. Service and maintain a lawn tractor. (Job Sheet #3)

    d. Calibrate and use a sprayer. (Job Sheet #4)

EQUIPMENT
UNIT II

ANSWERS TO TEST

1.

a.	12	e.	9	i.	3
b.	6	f.	10	j.	13
c.	4	g.	7	k.	1
d.	15	h.	16	l.	8

2.
a. 2
b. 1
c. 3

3.
a. Reel mower
b. Rotary mower

4.
a. Grooming mower
b. Rotary tiller
c. Rotary broom (brush)
d. Front blade
e. Post hole auger
f. Utility cart
g. Seed/fertilizer spreader
h. Sprayer
i. Lawn aerator
j. Disk
k. Front-end loader
l. Wood splitter

5.
a. Stump chipper
b. Trencher
c. Tree spade
d. Skid steer loader
e. Truckster
f. Backhoe with bucket and blade

6.

a.	F	f.	T
b.	F	g.	F
c.	T	h.	F
d.	T	i.	T
e.	T	j.	F

7.
a. T
b. G
c. RI
d. RO
e. B

ANSWERS TO TEST

8. Any two of the following:

   a. Gasoline
   b. Diesel
   c. Liquified petroleum (LP)

9. a. Hydraulic
   b. Hydrostatic

10. a. 4
    b. 2
    c. 1
    d. 3
    e. 6

11. a. Outside
    b. Vapor
    c. More
    d. Less
    e. Less

12. a. T
    b. T
    c. T
    d. F
    e. F
    f. F
    g. F
    h. F
    i. T
    j. T

13. a. O
    b. D
    c. I

14. a. Correct timing of application
    b. Proper chemicals and rates
    c. Proper equipment

15. a. Backpack
    b. Large boom

16. a. 8
    b. 6
    c. 1
    d. 4
    e. 7
    f. 5
    g. 9
    h. 3

ANSWERS TO TEST

17. a. Solid cone
    b. Flat (fan)

18. a. Body
    b. Strainer
    c. Tip
    d. Cap

19. a. The pesticide residue rinsed out will not contaminate the environment.
    b. Water
    c. Either kerosene or a detergent solution
    d. Daily
    e. Ammonia
    f. Light oil

20. To determine the volume of liquid sprayed per acre under specific conditions so that the proper amount of chemical can be applied.

21. Any two of the following:

    a. Make sure the sprayer was cleaned properly.
    b. Check for leaks.
    c. Check to see if sprayer is working properly using water to test.
    d. Select the proper pressure.
    e. Plan to calibrate the sprayer under conditions similar to those under which it will be used.

22.-25. Evaluated to the satisfaction of the instructor

26. Performance skills evaluated to the satisfaction of the instructor

IRRIGATION SYSTEMS AND MAINTENANCE
UNIT III

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify the basic parts of a sprinkler system and perform common maintenance tasks. Competencies will be demonstrated by completing the assignment sheets, job sheets, and the unit tests with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms related to irrigation systems and maintenance with the correct definitions.
2. Match the basic parts of a sprinkler system with the correct descriptions.
3. Distinguish between the ways sprinkler heads distribute water.
4. Match the types of sprinkler heads with the correct descriptions.
5. Identify the two basic sprinkler head distribution patterns.
6. Distinguish between the types of pipes and fittings used for sprinkler systems.
7. Distinguish between the methods of operating sprinkler systems.
8. Match miscellaneous equipment used in a sprinkler system with the correct descriptions.
9. Select from a list the common needs for servicing a sprinkler system.

OBJECTIVE SHEET

10. Complete statements about winterizing irrigation systems.
11. Identify parts of a sprinkler system. (Assignment Sheet #1)
12. Read an irrigation system drawing. (Assignment Sheet #2)
13. Demonstrate the ability to:
    a. Repair and replace PVC pipe and fittings. (Job Sheet #1)
    b. Repair and replace polyethylene pipe and fittings. (Job Sheet #2)
    c. Replace a sprinkler head. (Job Sheet #3)

IRRIGATION SYSTEMS AND MAINTENANCE
UNIT III

SUGGESTED ACTIVITIES

A. Obtain additional materials and/or invite resource people to class to supplement/reinforce information provided in this unit of instruction.

(NOTE: This activity should be completed prior to the teaching of this unit.)

B. Provide students with objective sheet.

C. Discuss unit and specific objectives.

D. Provide students with information and assignment sheets.

E. Discuss information and assignment sheets.

F. Provide students with job sheets.

G. Discuss and demonstrate the procedures outlined in the job sheets.

H. Integrate the following activities throughout the teaching of this unit:

1. Visit an irrigation dealer (such as a Toro or Rainbird dealer) and look at different sprinkler parts that are available for use in systems.

2. Visit a local home or business where an irrigation system is in use and study how it works.

I. Give test.

J. Evaluate test.

K. Reteach if necessary.

RESOURCES USED IN DEVELOPING THIS UNIT

A. Ed. Porter, John Paul, et al. *Landscaping*. Alexandria, VA: Time-Life Books, 1983.

B. Buckstrom, Robert J., Ed. Shakery, Karen. *Ortho's Home Improvement Encyclopedia*. San Francisco, CA: Chevron Chemical Company, 1985.

C. Cotton, Lin, Ed. A. Cort Sinnes. *All About Landscaping*. San Francisco, CA: Chevron Chemical Company, 1980.

D. Van Leeuwen, Roger A. *Design and Install Your Own Lawn Sprinkler System*. Tulsa, OK: Dexter Publishing Co., 1978.

RESOURCES USED IN DEVELOPING THIS UNIT

E. *Grounds Maintenance*, Volume 22, Number 6. Overland Park, KS: Intertec Publishing Corporation, 1987.

F. *Grounds Maintenance*, Volume 22, Number 5. Overland Park, KS: Intertec Publishing Corporation, 1987.

G. *Landscape and Irrigation*, Volume 11, Number 2. Encino, CA: Gold Trade Publications, Inc., 1987.

H. *Toro-Design Information for Large Turf Irrigation Systems*. Riverside, CA: The Toro Company, Irrigation Division, 1972.

I. *Residential and Commercial Turf Irrigation Systems Information*. Riverside, CA: The Toro Company, 1975.

J. *Irrigation*, 5th ed. Arlington, VA: The Irrigation Association, 1983.

K. *The ABC's of Lawn Sprinkler Systems*. Lafayette, CA: Irrigation Technical Services, 1966.

SUGGESTED SUPPLEMENTAL RESOURCES

A. VHS videotapes available from Rain Bird distributors or call (818) 963-9311.

1. *Basic Controller Troubleshooting*, D38826
2. *Troubleshooting Impacts, Rotors, & Valves*, D38827
3. *Troubleshooting Rotor Pop-Ups*, D38846
4. *General Maintenance*, D38868

B. *Irrigation* (filmstrips or slides with accompanying cassettes and study guides, #263). Available from

Bergwall Productions, Inc.
P.O. Box 238
Garden City, NY 11530-0238
800-645-3565 or 516-222-1111 in New York

C. *Planning for an Irrigation System*, slide set. Available from

AAVIM
120 Driftmier Engineering Center
Athens, GA 30602

IRRIGATION SYSTEMS AND MAINTENANCE
UNIT III

INFORMATION SHEET

I. **Terms and definitions**

A. Absorption rate — The rate at which a soil will absorb water

B. Application rate — The rate at which water is applied to the turf by the sprinklers

C. Backflow — Water which drains back or is sucked back from irrigation lines

(NOTE: Backflow preventers or antisiphon devices are commonly used on lines to prevent backflow water which could contain insecticides, fertilizers, or bacteria from contaminating the domestic water supply.)

D. Block of heads — A section of sprinklers controlled by one valve

E. Class of pipe — A method by which pipe is grouped according to the working pressure at which it can be used

Example: Class 160 pipe can be used where pressures do not exceed 160 P.S.I.

F. Domestic (potable) water — Water meant for human consumption; must be protected from contamination

G. Flow — The movement of water through pipe

H. Flow restrictions — Physical restrictions in the line of water flow; can be planned such as valves or pressure regulators or unplanned such as corrosion

I. Gallons per minute (G.P.M.) — Measures the standard flow of water in irrigation design

J. Lateral — A pipe line of a smaller size than the main, branching off from the main

K. Main — A large pipe sized to carry the water for the irrigation system

(NOTE: Usually sprinklers are not connected directly to the main.)

L. Pounds per square inch (P.S.I.) — Measures the standard pressure of water in irrigation design

INFORMATION SHEET

M. Rating of pipe — A rating given to pipe to indicate the wall thickness or pressure under which the pipe can operate

N. Run-off — Water which is not absorbed by the turf to which it is applied; occurs when there is a severe slope or when water is applied at too great a rate or for too long a time

O. Schedule of pipe — Classification of pipe based on the wall thickness

P. Section — A group of heads and/or valves which operate on one station or at one time

Q. Spacing — The distance between sprinkler heads

R. Surge — An energy wave in pipe lines caused by sudden opening or closing of valves

Definitions courtesy of The Toro Company

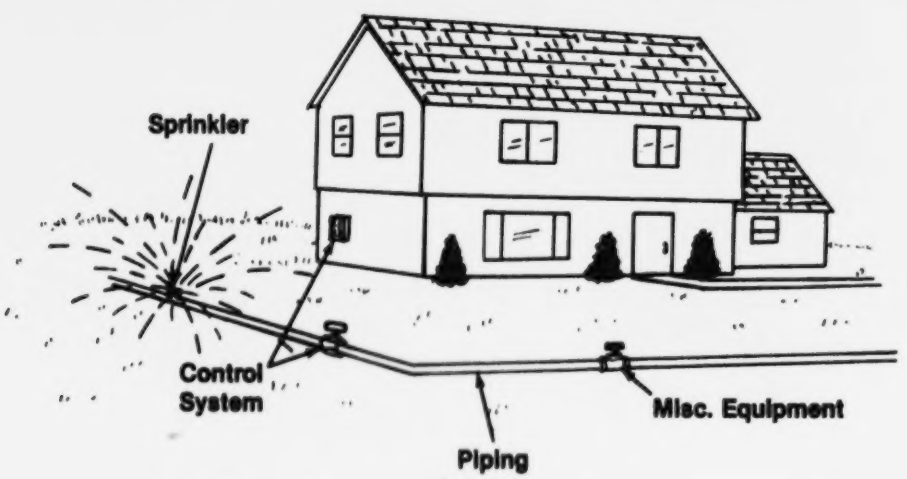
II. Basic parts of a sprinkler system

A. Sprinklers (sprinkler heads) — Direct water through holes or nozzles called emitters to specified areas

B. Piping — Various types of pipes and fittings used to carry water from the source to the sprinkler heads

C. Control system — Automatic valves and controller which operate the sprinkler system according to pre-set programs

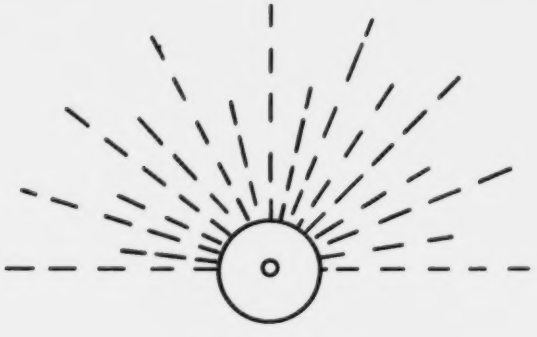
D. Miscellaneous equipment — Valves, regulators, pumps, and other devices used in a sprinkler system to regulate and control the flow of water



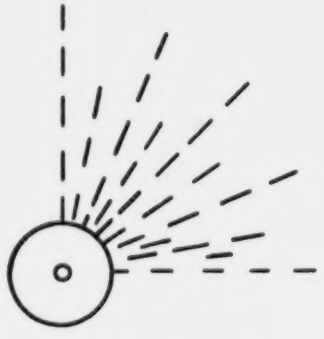
INFORMATION SHEET

III. Ways sprinkler heads distribute water

A. Fixed spray — Fixed nozzles distribute water throughout entire area at one time; used for relatively small areas of coverage (residential and small commercial)

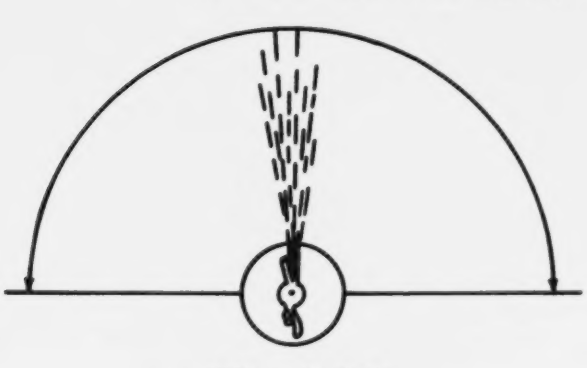


180° — 1/2 circle
(various arcs available)

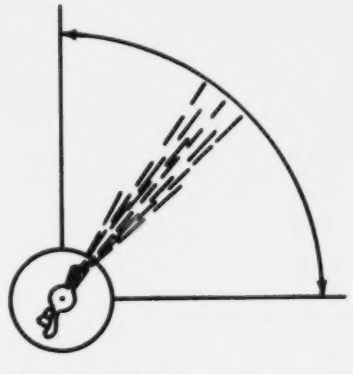


90° — 1/4 circle

B. Rotary stream — Rotating nozzles distribute water back and forth between set area limits; used for large, open turf areas



180° — 1/2 circle
(various arcs available)



90° — 1/4 circle

INFORMATION SHEET

IV. Types of sprinkler heads

A. Fixed spray

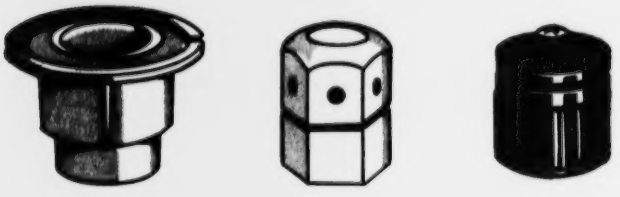
1. Stationary or fixed lawn spray — Sprays out water over the lawn area; installed flush with the surface of the soil

2. Pop-up lawn spray — Distributes the water the same as the stationary lawn spray except that the water pressure pushes the nozzles up 1" to 12" above the grade; when water is shut off, they drop back down to grade

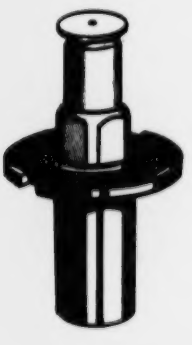
3. Stationary shrub spray — Small heads installed above ground level on top of risers high enough for spray to clear the top of foliage if watering is to be over the plants, or on lower risers if water is to be distributed over the surface of the soil

INFORMATION SHEET

4. Bubble, flood, or spider — Small heads mounted just above the ground in flower or shrubbery beds where a spray of water would not be acceptable; used to gently flood the area



5. Stream jet — Used for slow application of water; pop-up lawn heads or shrubbery heads which utilize nozzles which emit water in small, fine streams



B. Rotary stream

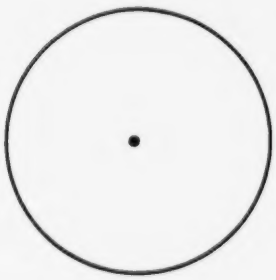
1. Rotary impact — Mounted above ground on risers or on couplers which fit into quick coupling valves, used in large lawn or garden areas, have one or more nozzles, and emit water in streams

INFORMATION SHEET

2. Rotary pop-up — Emit water through one or more nozzles; their covers are flush with the grade and are raised or lowered by the rise or fall of the water pressure

V. Sprinkler distribution patterns

A. Full circle (360°)



B. Part circle (various arcs)

¾ circle

½ circle

¼ circle

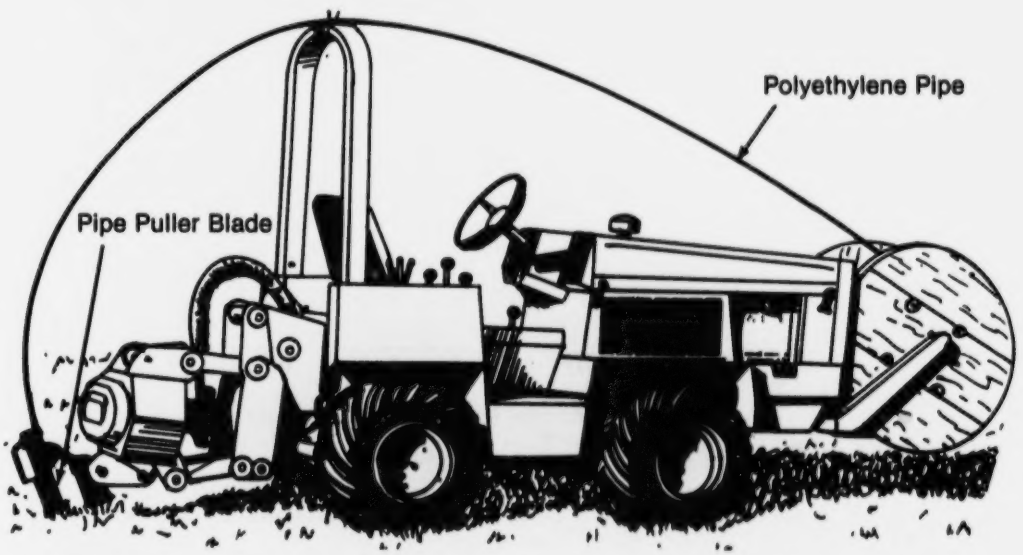
(Many other arcs are available)

INFORMATION SHEET

VI. Types of pipes and fittings used for sprinkler systems

A. Polyethylene (PE or poly)

1. Has relatively thick walls, is flexible, and is commonly used in colder regions because water freezing inside poly pipe will not burst the pipe.
2. Is available in 80 and 100 P.S.I. ratings.
3. Common sizes for residential systems are 3/4" and 1".
4. Poly pipe is installed by trenching or by pulling with a pipe puller.



Ditch Witch is a registered trademark of the Charles Machine Works, Inc. Used with permission.

5. Pieces of poly pipe are connected with insert fittings which are placed on the inside of two pipe ends. A clamp is then used to secure the fitting.

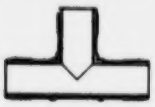
INSERT FITTING (COUPLING) JOINING PLASTIC PIPE.

SAME JOINT SHOWING CLAMPS IN PLACE.

INFORMATION SHEET

6. Insert fittings are available in various sizes of tees, elbows (ells), adapters, reducers, crosses, and couplings.

TEE (Insert x Insert x Insert)

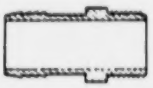


TEE (Insert x Insert x Mipt)

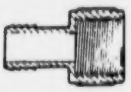
TEE (Insert x Insert x Fipt)

90° ELL (Insert x Insert)

MALE ADADPTER (Insert x Mipt)



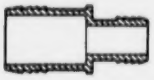
FEMALE ADAPTER (Insert x fipt)



CROSS (Insert)

COUPLING (Insert x Insert)

REDUCER COUPLING (Insert x Insert)



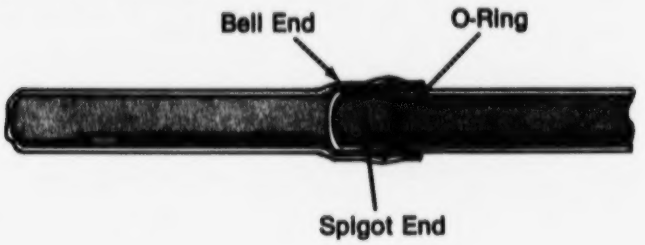
7. There are two types of clamps that can be used with insert fittings.
   a. Stainless steel hose clamp with a screw for tightening
   b. Pinch clamp with a special tool for pinching
8. When securing the fitting, make sure the clamp is on the *ribs* of the fitting to prevent leaks.

B. Polyvinyl chloride (PVC)

1. Is semi-rigid, has good tensile strength, and provides greater working pressure (160 P.S.I., 200 P.S.I., and 315 P.S.I) than poly pipe (80 P.S.I and 100 P.S.I.)
2. Has better flow characteristics than poly pipe which has flow restrictions caused by the internal fittings.
3. PVC pipes are joined by solvent weld processes, threaded fittings, or bell and spigot connections.
   a. The surfaces of solvent weld joints must be properly primed and the solvent cement must be uniformly applied.
   b. Liquid or paste sealants suitable for PVC pipe or Teflon tapes are used for leakproof threaded fittings. The fittings should be 1-1 ½ turns past "finger tight." **Do not** overtighten!

INFORMATION SHEET

c. Bell and spigot connections use gaskets or O-rings to prevent leaks between pipe pieces. These connections are commonly used on pipe 3" and up, especially for longer runs. This type of connection allows for expansion and contraction which would pull apart other joints.



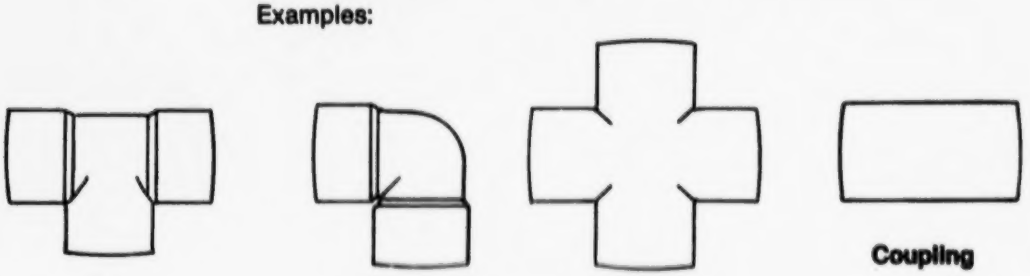
4. If water is allowed to freeze in PVC pipe, the expanding water (ice) will crack or burst the pipe. Therefore, all lines must be drained in the winter.

5. PVC pipe is available in classes 160, 200, and 315 or schedules 40 or 80, types 1 and 2, and in various pipe sizes (½" - 6").

6. PVC is installed by trenching.

7. PVC fittings are available in various sizes of tees, elbows (ells), adapters, reducers, crosses, and couplings.

Examples:



Fittings are available with various types of ends.

INFORMATION SHEET

VII. Methods of operating sprinkler systems

A. Manual — Conventional valves control the water flow which must be turned on and off by hand.

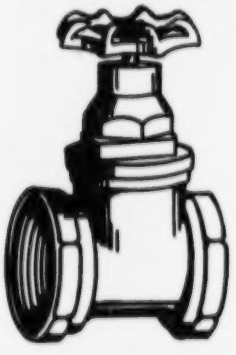
B. Automatic — Remote control valves are connected to a controller which turns the valves on and off automatically according to a pre-set schedule.

(NOTE: Wire is used to link the electric remote control valves with the controller, and PVC or polyethylene tubing links hydraulic remote control valves and the controller.)

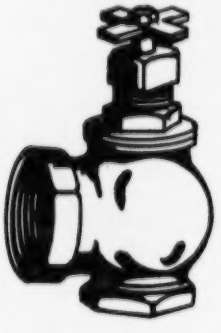
VIII. Miscellaneous equipment used in a sprinkler system

A. Valves

1. Gate valves — Shut off water in main lines and regulate flow of water



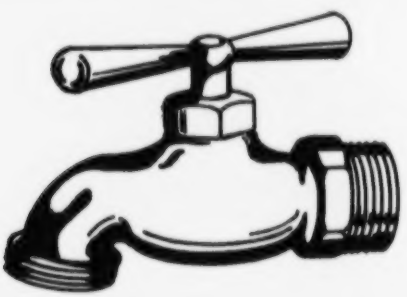
2. Angle valves — Seal off flow of water by a floating neoprene or rubber disc which closes against a brass seat



INFORMATION SHEET

3. Check valves — Installed in piping systems to limit water flow in one direction and prevent backflow

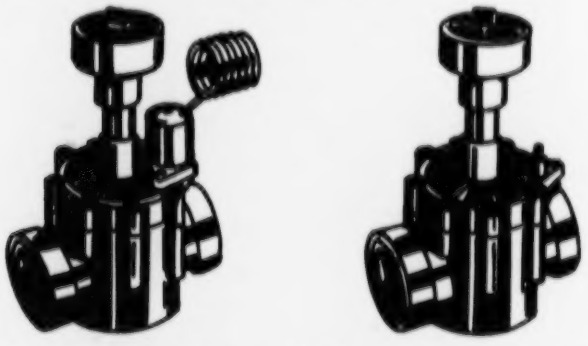
4. Hose bibs — Regulate the flow of water to hoses



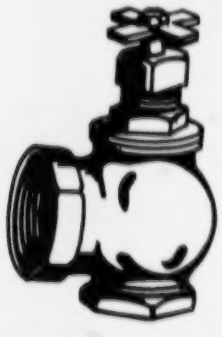
5. Quick coupling valves — Valves attached to main lines or lateral lines under constant pressure; have a hinged lid. To get water a coupler must be inserted and given a partial turn which opens the valve. A sprinkler head or hose can be attached to the coupler.

INFORMATION SHEET

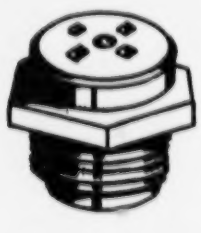
6. Remove control valves — Electrically or hydraulically operated circuit valves operated by a controller



7. Manual drain valves — Used to drain the water out of pipes and sprinkler heads in freezing climates

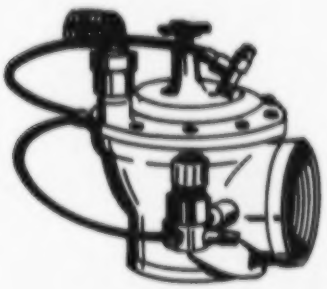


8. Automatic drain valves — Spring and ball combinations which close when water is turned on and the pressure builds up to about 3 P.S.I.

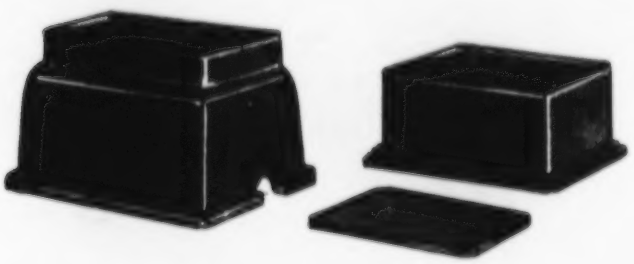


INFORMATION SHEET

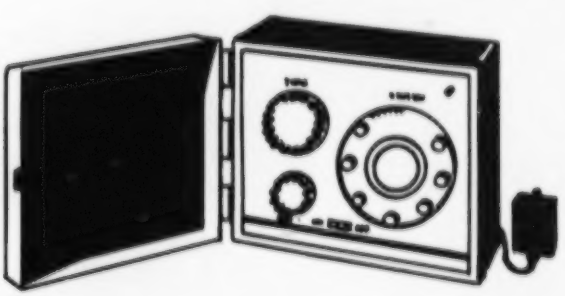
9. Pressure regulating and relief valves — Used to control water pressures in the lines

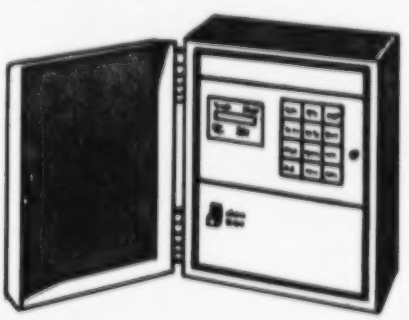


10. Valve boxes — Used to protect valves and make it easier to get to valves in case service work is needed



B. Controllers — Timing devices which can be set at a certain time to open and close the electric or hydraulic remote control valves





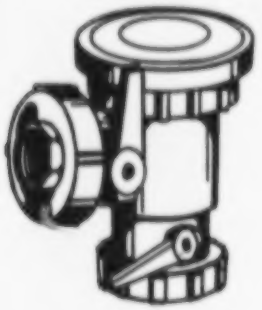
C. Electric wiring — Plastic coated, copper, direct burial wire which transmits signals from the controller to the electric remote control valves

(NOTE: For electrical code requirements in your area contact the local Electrical Inspectors office or your sprinkler equipment dealer.)

INFORMATION SHEET

D. Hydraulic tubing — PVC or polyethylene tubing which transmits signals from the controller to the hydraulic remote control valves

E. Antisiphon devices — Installed on sprinkler systems which use domestic (potable) water to prevent contaminates from being siphoned back into the water supply



F. Risers — Connections between sprinkler heads and lateral piping. Should be of flexible material to withstand shock of people walking on them or being struck by wheels of mowing equipment.

G. Pump — Used as a prime pressure source in a system or as an in-line pressure booster

1. Booster pump — Boosts the water pressure in the system; used where water pressure is low or in a very large system

2. System supply pump — Supplies the system with sufficient water supply and pressure

INFORMATION SHEET

IX. Common needs for servicing the sprinkler system

A. Sprinkler problems

1. Random dry spots — Check for plugged nozzles and screens, blocked nozzles, and correct arcs

2. Uniform dry spots — Check operating pressures and flow controls on master, anti-siphon, and automatic valves

B. Equipment breakage

1. Saturated spots and reduced operating pressure — Check for broken pipes or fittings

2. Saturated area around the sprinkler — Check for broken risers

C. Control system malfunctions (Handout #1)

1. System will not operate — Check controller and control lines. Lines may be cut or controller may be malfunctioning or incorrectly programmed.

2. Part of a system will not operate — Check control lines, valves, and station selector circuit of the controller. Valves may be faulty or controller malfunctioning or incorrectly programmed.

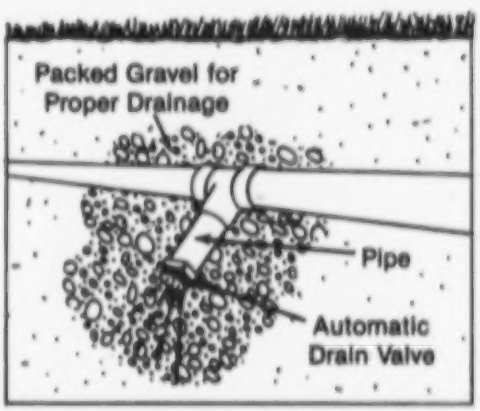
X. Winterizing the irrigation system

A. In freezing areas, automatic drain valves should be installed at low points in each circuit.

B. This drain valve attaches to a reducer tee and empties through a short section of pipe into a bed of packed gravel to allow for proper drainage.

C. Slope the drain pipe downward at a 45° angle.

D. When the sprinkler system shuts off, the automatic drain valves open and release water so that no water is standing in the pipes at any time.



IRRIGATION SYSTEMS AND MAINTENANCE
UNIT III

HANDOUT #1 — CONTROL SYSTEM PROBLEM SOLVING GUIDE

CODE	
PT = Pin Type NO = Normally Open NCV = Normally Closed Vented or Normally Closed	E = Electric A = All Systems

SYMPTOM	PROBLEM	ACTION
Valves come on and system waters when it's not supposed to.	PT or NO Control tubing between valve and controller is severed.	PT Shut off valves by plugging tubing on the valve side. Repair with tubing coupler and two retainers. NO Repair the tubing or use a manual valve to shut off the water supply.
Valve will not come on.	NCV Control tubing between valve and controller is severed.	Tubing must be repaired using a tubing coupler and retainers.
	E A control wire between valve and controller is severed.	Wire must be repaired or spliced and waterproofed.
No valves will open. System does not water.	A Incorrect controller programming.	Make sure pin is inserted in hour wheel. Make sure day wheel pins are *removed* on watering day with 11 Station controllers. Make sure stations are set for running time. Make sure hour wheel is at proper time. (If not, electric power has been interrupted, is now off, or controller is malfunctioning.) Make sure slide switch is set on "Automatic" on 11 Station controller. Check main shut-off valves and other manual valves to make sure they are open. Turn each station on manually. If valves operate, recheck previous points since a controller problem is indicated. Check for blown fuse.
	E Blown fuse. Common line cut or broken.	Check 24-volt fuse. Check for low voltage on valve solenoid. A minimum of 19 volts is necessary for valve opening. With less, a clicking sound can be heard at the valve without it opening. Line must be repaired.
	NCV Cut or blocked supply tube at controller.	Check line by removing it from its controller connection. If strong flow of water is not present, tube is probably cut or blocked and must be repaired.
One or selected valves won't open. No water in one coverage area.	A Incorrect controller programming. Controller malfunction. Main valve is closed.	Check controller settings. Operate valves manually at the controller. If valves work, controller problem is indicated. Check manual gate valve and/or flow control valves.

HANDOUT # 1

SYMPTOM	PROBLEM	ACTION
	NO or PT Plugged controller discharge line.	Check discharge line. Water should discharge when a station is turned on. If not, remove discharge line and check for discharge at fitting. If no discharge is present, controller problem is indicated.
One valve won't close. System keeps watering in one area.	**A** Controller stuck on station.	Check controller for loss of power. Check automatic/manual switch.
	PT Faulty valve. Faulty controller pilot valve.	Remove tubing from valve and plug the tube fitting on the valve. If the valve stays open, the valve is faulty. Valve must be replaced. Reconnect tubing at valve. Remove it from controller and plug tubing. If valve shuts off, the pilot valve is faulty. If valve stays open, a tubing problem is indicated.
	NO Controller problem. Cut tubing. Faulty valve.	A strong flow of water should be present when control tube is removed from the valve or controller. If no flow is present at the controller, a controller problem is indicated. If no flow is present at the valve, a cut in tubing is indicated. If flow is present at valve, valve is faulty.
	NVC Controller problem. Valve problem.	There should be no water flow in the control line when station is in OFF position. Water flow indicates a controller problem. No water flow indicates a valve problem.
	E Controller problem. Valve problem.	No electric current should be present in the control wires to the solenoid when a station is in the OFF position. If current is present, a controller problem is indicated. No current indicates a valve problem.

Courtesy of The Toro Company

(NOTE: For repairing valve and/or controller problems, it is suggested that you contact your equipment contractor or distributor. If you want to repair valves and controllers yourself, detailed service manuals are available from your distributor.)

IRRIGATION SYSTEMS AND MAINTENANCE
UNIT III

ASSIGNMENT SHEET #1 — IDENTIFY PARTS OF A SPRINKLER SYSTEM

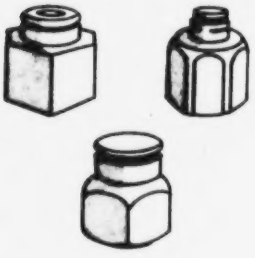
NAME _____ SCORE _____

Directions: Name each part of a sprinkler system which follows.

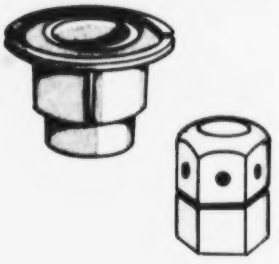
1. _____

2. _____

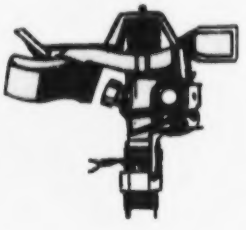
3. _____



4. _____

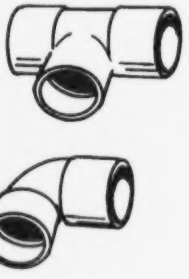


5. _____



6. _____

7. _____



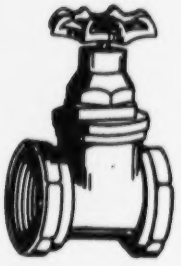
8. _____

9. _____

ASSIGNMENT SHEET #1

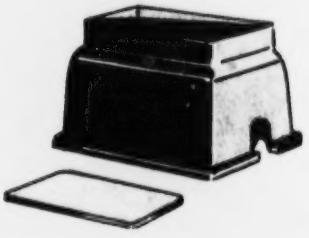
10. _____

11. _____

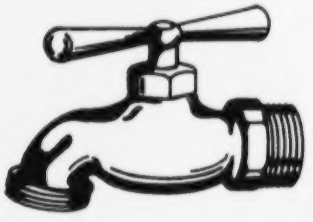


12. _____

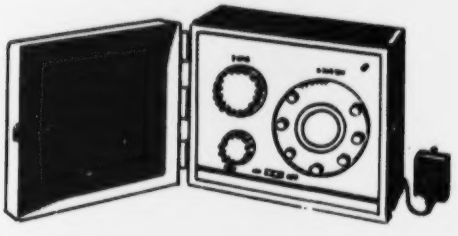
13. _____



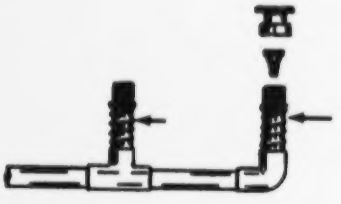
14. _____



15. _____



16. _____



17. _____

IRRIGATION SYSTEMS AND MAINTENANCE
UNIT III

ASSIGNMENT SHEET #2 — READ AN IRRIGATION SYSTEM DRAWING

NAME _____ SCORE _____

Directions: Read the diagram on the next page and answer these questions.

1. What is the symbol for pop up rotary head?

2. What is the symbol for pop up lawn spray head?

3. What is the symbol for bubble head?

4. What is the symbol for shrub spray head?

5. What is the symbol for electric remote control valve?

6. What is the symbol for antisiphon device?

7. What is the symbol for 1" water meter?

8. What is the symbol for PVC pipe?

9. How many of each kind of spray heads are in this diagram?

   _____a. Pop up rotary head

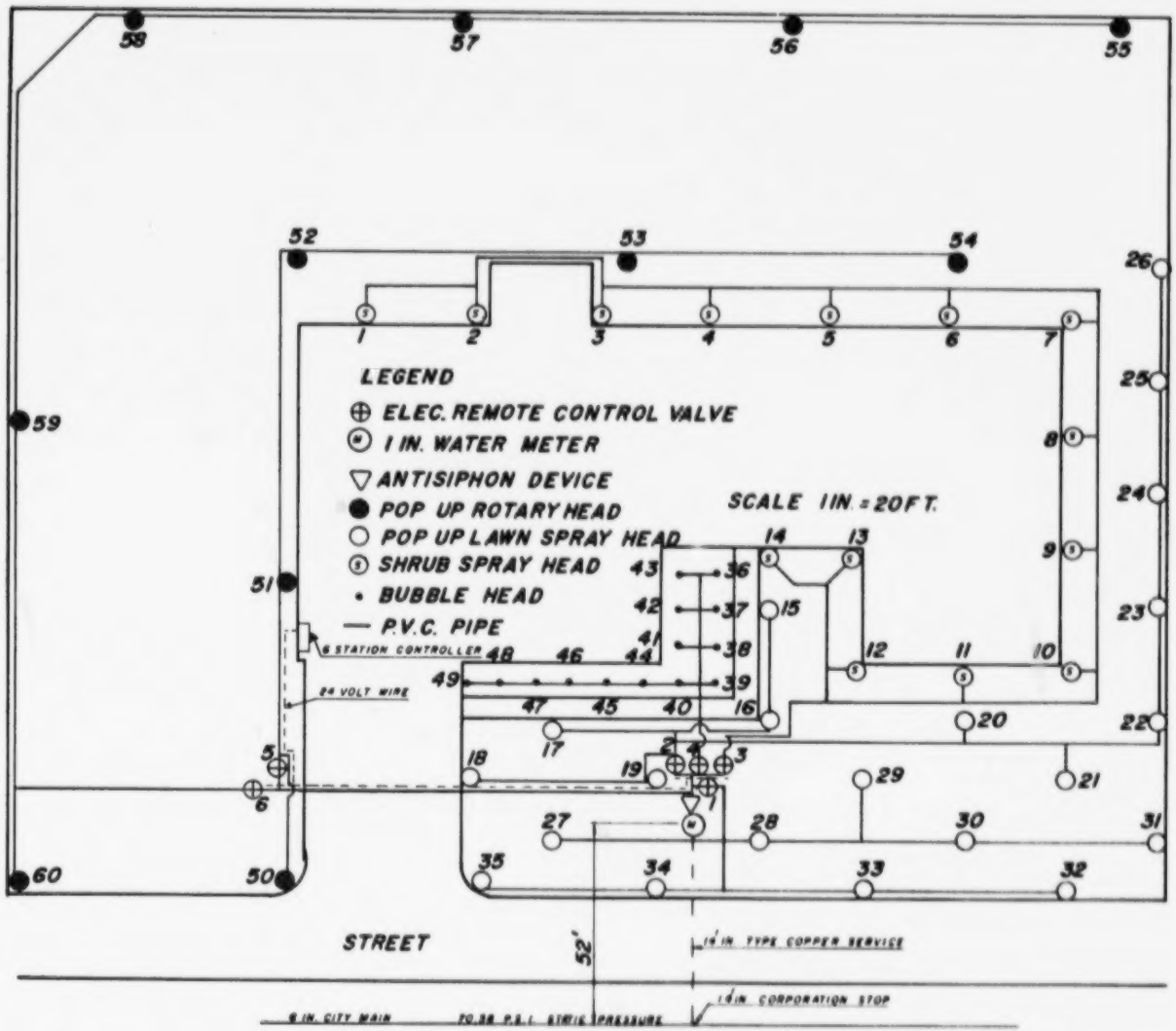
   _____b. Pop up lawn spray head

   _____c. Shrub spray head

   _____d. Bubble head

10. How many electric remote control valves are shown on the diagram? _____

ASSIGNMENT SHEET #2



This drawing is courtesy of Roger A. Van Leeuwen.
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IRRIGATION SYSTEMS AND MAINTENANCE
UNIT III

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1. Stream jet sprinkler head
2. Stationary or fixed lawn spray sprinkler head
3. Pop-up lawn spray sprinkler head
4. Stationary shrub spray sprinkler head
5. Bubble or flood sprinkler head
6. Rotary impact sprinkler head
7. Rotary pop-up sprinkler head
8. PVC fittings
9. PVC pipe
10. Polyethylene pipe and insert fittings
11. Angle valve
12. Gate valve
13. Check valve
14. Valve box
15. Hose bib
16. Controller
17. Riser

Assignment Sheet #2

1.
2.
3.
4.
5.
6.
7.
8.

ANSWERS TO ASSIGNMENT SHEETS

9. a. 11
   b. 21
   c. 14
   d. 14

10. 6

IRRIGATION SYSTEMS AND MAINTENANCE
UNIT III

JOB SHEET #1 — REPAIR AND REPLACE PVC PIPE AND FITTINGS

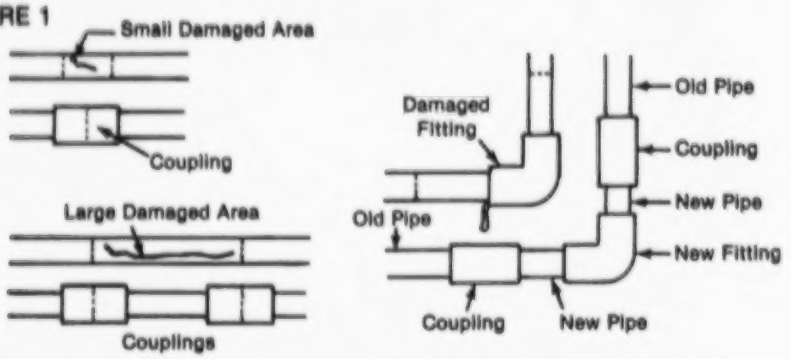
A. Tools and equipment

1. Hacksaw or PVC cutter
2. PVC pipe and fittings
3. Knife
4. PVC pipe cleaner
5. PVC solvent cement
6. Clean cloth
7. Sandpaper

B. Procedure

1. Study the diagram below and using the procedure described, solvent weld two sections of PVC pipe together using a fitting.

FIGURE 1



2. Use a hacksaw or PVC cutter to cut out the damaged part of the pipe.

(NOTE: Remove shavings to prevent contamination of valves or heads.)

FIGURE 2

JOB SHEET #1

3. Cut off the burrs and taper edges slightly.

FIGURE 3

4. Wipe ends with a cloth to remove dirt or debris.

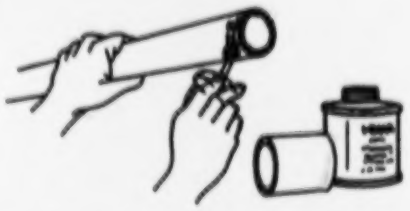
5. Use pipe cleaner on both edges that are being joined (pipe to coupler) to remove the glaze of the pipe.

6. Apply solvent cement to each surface.

   a. Heavily coat pipe end.

   b. Lightly coat inside fitting.

FIGURE 4



7. Quickly join the two pieces and twist them into alignment.

FIGURE 5

8. Remove excess solvent around joint.

9. Wait at least two minutes before handling the joint again and wait until the next day before testing it with water.

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IRRIGATION SYSTEMS AND MAINTENANCE
UNIT III

JOB SHEET #2 — REPAIR AND REPLACE POLYETHYLENE PIPE AND FITTINGS

A. Tools and equipment

1. Handsaw or knife
2. Polyethylene (PE or poly) pipe
3. Insert fittings (correct sizes for pipe)
4. Clamps (hose or pinch)
5. Screwdriver to fit hose clamps or special pinching tool for pinch clamps
6. Clean cloth

B. Procedure

1. Use a handsaw or knife to cut out the damaged part of the pipe.

   (NOTE: Remove shavings to prevent contamination of valves or heads.)

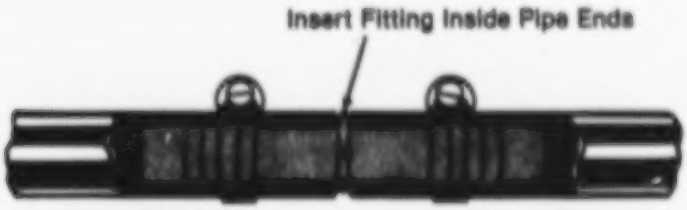
2. Wipe surfaces with a clean cloth to remove dirt or debris.
3. Loosen two clamps and slip one on each of the two pipes to be joined.

FIGURE 1

JOB SHEET #2

4. Place the insert fitting inside both pipe ends.

FIGURE 2



(NOTE: Plain water or soapy water may be used as a lubricant when joining. However, DO NOT use oil or detergent on any fittings.)

5. Adjust clamps so they are positioned on the ribs (grooves) of the fitting.

6. Tighten the clamps with a screwdriver (for hose clamps) or a special pinching tool (for pinch clamps).

(NOTE: When using insert fittings with previously installed metallic systems or threaded fittings, the insert adapter is used. The threaded end of the adapter should be wrapped with Teflon tape and tightened into the female connection. Clamp is then applied to ribbed end of insert fitting as described in this job sheet.)

IRRIGATION SYSTEMS AND MAINTENANCE
UNIT III

JOB SHEET #3 — REPLACE A SPRINKLER HEAD

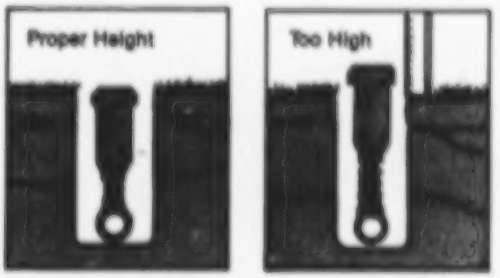
A. Tools and equipment

1. Replacement sprinkler head
2. Replacement pipe and fittings appropriate for system
3. Hacksaw
4. Knife
5. Measuring rule or tape

B. Procedure

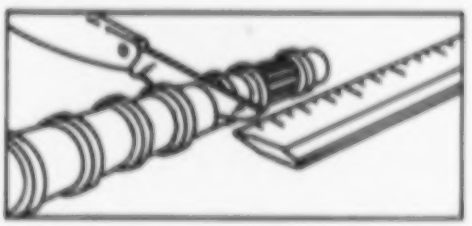
1. Replace any damaged pipe or fittings. (Job Sheet #1 and #2)
2. Remove damaged sprinkler head, and attach new head to riser.
3. Check the height of the head using measuring rule or tape.

FIGURE 1



4. Cut riser if necessary.

FIGURE 2



JOB SHEET #3

5. Re-install head so that top is flush with ground level.
6. Check system for proper operation.

Courtesy of the Toro Company

IRRIGATION SYSTEMS AND MAINTENANCE
UNIT III

PRACTICAL TEST
JOB SHEET #1 — REPAIR AND REPLACE PVC PIPE AND FITTINGS

STUDENT'S NAME _____ DATE _____

EVALUATOR'S NAME _____ ATTEMPT NO. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

(EVALUATOR NOTE: Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.)

The student:	YES	NO
1. Checked out proper tools and materials.	_____	_____
2. Cut pipe apart properly.	_____	_____
3. Cut off burrs and tapered edges.	_____	_____
4. Wiped with cloth.	_____	_____
5. Applied pipe cleaner.	_____	_____
6. Applied solvent cement.	_____	_____
7. Joined the two pieces together correctly.	_____	_____
8. Removed excess solvent.	_____	_____
9. Waited at least 2 minutes before handling joint.	_____	_____
10. Checked in/put away tools and materials.	_____	_____
11. Cleaned the work area.	_____	_____
12. Used proper tools correctly.	_____	_____
13. Performed steps in a timely manner. (___hrs. ___min. ___sec.)	_____	_____
14. Practiced safety rules throughout procedure.	_____	_____
15. Provided satisfactory responses to questions asked.	_____	_____

EVALUATOR'S COMMENTS: _____

_____

JOB SHEET #1 PRACTICAL TEST

PRODUCT EVALUATION

(EVALUATOR NOTE: Rate the student on the following criteria by circling the appropriate numbers. Each item must be rated at least a "3" for mastery to be demonstrated. (See performance evaluation key below.) If the student is unable to demonstrate mastery, student materials should be reviewed and another product must be submitted for evaluation.)

Criteria:

	4	3	2	1
Pipe was cut correctly				
	4	3	2	1
Correct amounts of cleaner and solvent were used				
	4	3	2	1
System does not leak				

EVALUATOR'S COMMENTS: _____

_____

PERFORMANCE EVALUATION KEY
4 — Skilled — Can perform job with no additional training. 3 — Moderately skilled — Has performed job during training program; limited additional training may be required. 2 — Limited skill — Has performed job during training program; additional training is required to develop skill. 1 — Unskilled — Is familiar with process, but is unable to perform job.

(EVALUATOR NOTE: If an average score is needed to coincide with a competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria.)

IRRIGATION SYSTEMS AND MAINTENANCE
UNIT III

PRACTICAL TEST
JOB SHEET #2 — REPAIR AND REPLACE POLYETHYLENE PIPE AND FITTINGS

STUDENT'S NAME _____ DATE _____

EVALUATOR'S NAME _____ ATTEMPT NO. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

(EVALUATOR NOTE: Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.)

The student:	YES	NO
1. Checked out proper tools and materials.	_____	_____
2. Cut pipe apart properly.	_____	_____
3. Loosened clamps and placed on pipe ends.	_____	_____
4. Placed insert fittings inside both pipe ends.	_____	_____
5. Adjusted clamps.	_____	_____
6. Tightened clamps.	_____	_____
7. Checked in/put away tools and materials.	_____	_____
8. Cleaned the work area.	_____	_____
9. Used proper tools correctly.	_____	_____
10. Performed steps in a timely manner. (___hrs. ___min. ___sec.)	_____	_____
11. Practiced safety rules throughout procedure.	_____	_____
12. Provided satisfactory responses to questions asked.	_____	_____

EVALUATOR'S COMMENTS: _____

_____

JOB SHEET #2 PRACTICAL TEST

PRODUCT EVALUATION

(EVALUATOR NOTE: Rate the student on the following criteria by circling the appropriate numbers. Each item must be rated at least a "3" for mastery to be demonstrated. (See performance evaluation key below.) If the student is unable to demonstrate mastery, student materials should be reviewed and another product must be submitted for evaluation.)

Criteria: _____

	4	3	2	1
Pipe was cut correctly				
	4	3	2	1
Clamps were correctly located				
	4	3	2	1
Clamps were tight				
	4	3	2	1
System does not leak				

EVALUATOR'S COMMENTS: _____

_____

PERFORMANCE EVALUATION KEY
4 — Skilled — Can perform job with no additional training. 3 — Moderately skilled — Has performed job during training program; limited additional training may be required. 2 — Limited skill — Has performed job during training program; additional training is required to develop skill. 1 — Unskilled — Is familiar with process, but is unable to perform job.

(EVALUATOR NOTE: If an average score is needed to coincide with a competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria.)

IRRIGATION SYSTEMS AND MAINTENANCE
UNIT III

PRACTICAL TEST
JOB SHEET #3 — REPLACE A SPRINKLER HEAD

STUDENT'S NAME _____ DATE _____

EVALUATOR'S NAME _____ ATTEMPT NO. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

(EVALUATOR NOTE: Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.)

The student:	YES	NO
1. Checked out proper tools and materials.	_____	_____
2. Replaced any damaged pipe or fittings.	_____	_____
3. Removed damaged head and attached new head.	_____	_____
4. Checked height of installed head.	_____	_____
5. Cut riser if necessary.	_____	_____
6. Re-installed head if necessary.	_____	_____
7. Checked system for proper operation.	_____	_____
8. Checked in/put away tools and materials.	_____	_____
9. Cleaned the work area.	_____	_____
10. Used proper tools correctly.	_____	_____
11. Performed steps in a timely manner. (___hrs. ___min. ___sec.)	_____	_____
12. Practiced safety rules throughout procedure.	_____	_____
13. Provided satisfactory responses to questions asked.	_____	_____

EVALUATOR'S COMMENTS: _____

_____

JOB SHEET #3 PRACTICAL TEST

PRODUCT EVALUATION

(EVALUATOR NOTE: Rate the student on the following criteria by circling the appropriate numbers. Each item must be rated at least a "3" for mastery to be demonstrated. (See performance evaluation key below.) If the student is unable to demonstrate mastery, student materials should be reviewed and another product must be submitted for evaluation.)

Criteria:				
	4	3	2	1
Sprinkler head is at correct height				
	4	3	2	1
Head does not leak				
	4	3	2	1
Head is straight and faces correct direction				

EVALUATOR'S COMMENTS: _____

_____

PERFORMANCE EVALUATION KEY
4 — Skilled — Can perform job with no additional training. 3 — Moderately skilled — Has performed job during training program; limited additional training may be required. 2 — Limited skill — Has performed job during training program; additional training is required to develop skill. 1 — Unskilled — Is familiar with process, but is unable to perform job.

(EVALUATOR NOTE: If an average score is needed to coincide with a competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria.)

IRRIGATION SYSTEMS AND MAINTENANCE
UNIT III

TEST

NAME _____ SCORE _____

1. Match the terms on the right with the correct definitions.

_____a.	A large pipe sized to carry the water for the irrigation system	1. Absorption rate
_____b.	The movement of water through pipe	2. Application rate
_____c.	Water which drains back or is sucked back from irrigation lines	3. Backflow
_____d.	The rate at which a soil will absorb water	4. Block of heads
_____e.	Measures the standard pressure of water in irrigation design	5. Class of pipe
_____f.	A section of sprinklers controlled by one valve	6. Domestic water
_____g.	Water meant for human consumption; must be protected from contamination	7. Flow
_____h.	The rate at which water is applied to the turf by the sprinklers	8. Flow restrictions
_____i.	Water which is not absorbed by the turf to which it is applied; occurs when there is a severe slope or when water is applied at too great a rate or for too long a time	9. Gallons per minute
_____j.	An energy wave in pipe lines caused by sudden opening or closing of valves	10. Gauge of wire
_____k.	Measures the standard flow of water in irrigation design	11. Lateral
_____l.	A pipe line of a smaller size than the main, branching off from the main	12. Main
_____m.	The distance between sprinkler heads	13. Pounds per square inch
		14. Rating of pipe
		15. Run-off
		16. Schedule of pipe
		17. Section
		18. Spacing
		19. Surge

TEST

2. Match the basic parts of a sprinkler system on the right with the correct descriptions.

_____a.	Direct water through holes or nozzles called emitters to specified areas	1. Control system
_____b.	Regulate and control the flow of water	2. Miscellaneous equipment
_____c.	Operate the sprinkler system according to pre-set programs	3. Piping
_____d.	Carry water from the source to the sprinkler heads	4. Sprinklers

3. Distinguish between the ways sprinkler heads distribute water by placing an "X" next to the description of a fixed spray head.

_____a. Nozzles distribute water throughout the entire area at one time; used for relatively small areas of coverage (residential and small commercial)

_____b. Nozzles distribute water back and forth between set area limits; used for large, open turf areas

4. Match the types of sprinkler heads on the right with the correct descriptions.

_____a.	Used for slow application of water; pop-up lawn heads or shrubbery heads which utilize nozzles which emit water in small, fine streams	1. Bubble, flood, or spider
_____b.	Small heads installed above ground level on top of risers high enough for spray to clear the top of foliage if watering is to be over the plants, or on lower risers if water is to be distributed over the surface of the soil	2. Pop-up lawn spray
_____c.	Small heads mounted just above the ground in flower or shrubbery beds where a spray of water would not be acceptable; used to gently flood the area	3. Rotary impact
_____d.	Mounted above ground on risers or on couplers which fit into quick coupling valves, used in large lawn or garden areas, have one or more nozzles, and emit water in streams	4. Rotary pop-up
_____e.	Sprays out water over the lawn area; installed flush with the surface of the soil	5. Stationary or fixed lawn spray
		6. Stationary shrub spray
		7. Stream jet

TEST

5. Identify the two basic sprinkler head distribution patterns.

a. _____ b. _____

6. Distinguish between the types of pipes and fittings used for sprinkler systems by placing the following letters next to the correct descriptions:

PVC — Polyvinyl chloride
PE — Polyethylene

_____a. Is available in 80 and 100 P.S.I. ratings.

_____b. Has better flow characteristics.

_____c. Are connected with insert fittings which are placed on the inside of two pipe ends. A clamp is then used to secure the fitting.

_____d. Are joined by solvent weld processes, threaded fittings, or bell and spigot connections.

_____e. Is installed by trenching or by pulling with a pipe puller.

_____f. Common sizes for residential systems are ¾" and 1".

_____g. Has relatively thick walls and is flexible.

_____h. Is commonly used in colder regions because water freezing inside this pipe will not burst the pipe.

_____i. Is semi-rigid, has good tensile strength, and provides greater working pressure.

_____j. Is installed by trenching.

_____k. Is available in classes 160, 200, and 315 or schedules 40 or 80, types 1 and 2.

TEST

7. Distinguish between the methods of operating sprinkler systems by placing an "X" next to the description of the manual method.

_____a. Remote control valves are connected to a controller which turns the valves on and off according to a pre-set schedule

_____b. Conventional valves control the water flow which must be turned on and off by hand

8. Match miscellaneous equipment used in a sprinkler system listed on the right with the correct descriptions.

_____a. Timing devices which can be set at a certain time to open and close the electric or hydraulic remote control valves

_____b. Electrically or hydraulically operated circuit valves operated by a controller

_____c. Used to protect valves and make it easier to get to valves in case service work is needed

_____d. Valves that shut off water in main lines and regulate flow of water

_____e. Spring and ball combination valves which close when water is turned on and the pressure builds up to about 3 P.S.I.

_____f. Valves installed in piping systems to limit water flow in one direction and prevent backflow

_____g. Valves used to control water pressures in the lines

_____h. Plastic coated, copper, direct burial wire which transmits signals from the controller to the electric remote control valves

_____i. PVC or polyethylene tubing which transmits signals from the controller to the hydraulic remote control valves

1. Antisiphon devices
2. Automatic drain valves
3. Booster pump
4. Check valves
5. Controllers
6. Electric wiring
7. Gate valves
8. Globe valves
9. Hydraulic tubing
10. Manual drain valves

TEST

_____j. Installed on sprinkler systems which use domestic (potable) water to prevent contaminates from being siphoned back into the water supply

_____k. Connections between sprinkler heads and lateral piping. Should be of flexible material to withstand shock of people walking on them or being struck by wheels of mowing equipment.

_____l. Pump that supplies the system with sufficient water supply and pressure

11. Pressure regulating and relief valves
12. Remote control valves
13. Risers
14. System supply pump
15. Valve boxes

9. Select from the following list the common needs for servicing a sprinkler system by placing an "X" next to the correct needs.

_____a. Impure water

_____b. Equipment breakage such as broken pipe, fittings, or risers

_____c. Broken municipal water lines

_____d. Sprinkler problems such as plugged nozzles and screens

_____e. Control system malfunctions such as part or all of system does not operate

_____f. Electrical supply problems such as power lines downed by a storm

10. Complete the following statements about winterizing irrigation systems by circling the correct answers.

a. In freezing areas, automatic drain valves should be installed at **(high, low)** points in each circuit.

b. This drain valve attaches to a reducer tee and empties through a short section of pipe into **(the main water line, packed gravel)**.

c. Slope the drain pipe downward at a **(10°, 45°)** angle.

(NOTE: If the following activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

11. Identify parts of a sprinkler system. (Assignment Sheet #1)

12. Read an irrigation system drawing. (Assignment Sheet #2)

TEST

13. Demonstrate the ability to:

    a. Repair and replace PVC pipe and fittings. (Job Sheet #1)

    b. Repair and replace polyethylene pipe and fittings. (Job Sheet #2)

    c. Replace a sprinkler head. (Job Sheet #3)

IRRIGATION SYSTEMS AND MAINTENANCE
UNIT III

ANSWERS TO TEST

1. a. 12
   b. 7
   c. 3
   d. 1
   e. 13
   f. 4
   g. 6
   h. 2
   i. 15
   j. 19
   k. 9
   l. 11
   m. 18

2. a. 4
   b. 2
   c. 1
   d. 3

3. a

4. a. 7
   b. 6
   c. 1
   d. 3
   e. 5

5. a. Part circle (various arcs)
   b. Full circle (360°)

6. a. PE
   b. PVC
   c. PE
   d. PVC
   e. PE
   f. PE
   g. PE
   h. PE
   i. PVC
   j. PVC
   k. PVC

7. b

8. a. 5
   b. 12
   c. 15
   d. 7
   e. 2
   f. 4
   g. 11
   h. 6
   i. 9
   j. 1
   k. 13
   l. 14

ANSWERS TO TEST

9. b, d, e

10. a. Low
    b. Packed gravel
    c. 45°

11.-12. Evaluated to the satisfaction of the instructor

13. Performance skills evaluated to the satisfaction of the instructor

PLANT MATERIAL IDENTIFICATION AND PESTS UNIT IV

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify basic characteristics which are used to identify plants, major pruning techniques, and basic disease and insect problems on plants. Competencies will be demonstrated by completing the assignment sheets, job sheets, and the unit tests with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms related to plant materials with the correct definitions.
2. Name characteristics used in plant identification.
3. Match common flower forms with the correct illustrations.
4. Match common leaf shapes with the correct illustrations.
5. Match common leaf tips with the correct illustrations.
6. Match common leaf margins with the correct illustrations.
7. Match basic leaf types with the correct illustrations.
8. Match leaf arrangements on a stem with the correct illustrations.
9. Explain how a lenticel can be used in identification.
10. Name differences that can be seen in bark that help in identification.

OBJECTIVE SHEET

11. Identify basic overall forms of plants.
12. Name reasons for pruning.
13. List pruning safety rules.
14. Match types of plants with the approximate time they should be pruned.
15. Complete a chart of insect pests and damage.
16. Complete a chart of plant disease problems.
17. Complete a chart of common plant groups.
18. Identify chemical treatments for insect pests. (Assignment Sheet #1)
19. Identify chemical treatments for plant diseases. (Assignment Sheet #2)
20. Identify specific plants. (Assignment Sheet #3)
21. List local plants. (Assignment Sheet #4)
22. Identify specific plant diseases. (Assignment Sheet #5)
23. Identify specific insect pests. (Assignment Sheet #6)
24. Demonstrate the ability to:
    a. Prune branches. (Job Sheet #1)
    b. Treat tree injury wounds. (Job Sheet #2)

PLANT MATERIAL IDENTIFICATION AND PESTS
UNIT IV

SUGGESTED ACTIVITIES

A. Obtain additional materials and/or invite resource people to class to supplement/reinforce information provided in this unit of instruction.

(NOTE: This activity should be completed prior to the teaching of this unit.)

B. Make transparencies from the transparency masters included with this unit.

C. Provide students with objective sheet.

D. Discuss unit and specific objectives.

E. Provide students with information and assignment sheets.

F. Discuss information and assignment sheets.

(NOTE: Use the transparencies to enhance the information as needed.)

G. Provide students with job sheets.

H. Discuss and demonstrate the procedures outlined in the job sheets.

I. Integrate the following activities throughout the teaching of this unit:

1. Provide the most recent chemical charts for controlling insects and diseases. The students will need to use these in Assignment Sheets #1 and #2.

2. Obtain a list of plants commonly found in your area from your state nurseryman association and have students identify as many of these as possible to supplement plant groups in this unit.

3. Make copies of the plant materials identification form included on the following page as a teacher supplement. Complete the forms for common plants in your locale that are not included in this unit.

   (NOTE: Additional plants will be covered in the third book in this series, but there will still be plants common to your area that are left out.)

4. Take a field trip to an area and look for any signs of plant disease that may be present. (Assignment Sheet #5)

5. Demonstrate how to collect a sample of a plant disease and send it to the laboratory for diagnosis. (Assignment Sheet #5)

SUGGESTED ACTIVITIES

6. Have students collect samples of common insects described in this unit and identify and display these samples. (Assignment Sheet #6)

7. Take a field trip and demonstrate proper pruning procedures. (Job Sheet #1)

8. Discuss the appropriate times for pruning specific plants in your area.

9. Meet individually with students to evaluate their progress through this unit of instruction, and indicate to them possible areas for improvement.

J. Give test.

K. Evaluate test.

L. Reteach if necessary.

RESOURCES USED IN DEVELOPING THIS UNIT

A. Whitcomb, Carl E. *Know It and Grow It II*. Stillwater, OK: Lacebark Publications, 1983.

B. *Extension Agents Handbook*. Oklahoma State University Extension, 1987.

C. Oklahoma State University Fact Sheets (OSU Extension)

1. *Ornamental and Lawn Pest Control*, #7306
Ken Pinkston, Richard Price, Paul S. Mitchell

2. *Plant Galls Caused by Insects*, #7168
Ken Pinkston, Don C. Arnold, Richard Price, Raymond D. Elkenbary

3. *Dutch Elm Disease Control*, #7602
R.V. Sturgeon, Jr., Louis Morrison, Kenneth E. Conway

D. *Common Insect Pests of Trees in the Great Plains*. Great Plains Agricultural Council Publication No. 119. Nebraska Cooperative Extension Service.

E. *Diseases of Trees in the Great Plains*. United States Department of Agriculture, Forest Service. Fort Collins, CO 80526.

F. *Landscape Plants for Iowa*. Cooperative Extension Service, Iowa State University, Ames, IA 50011.

SUGGESTED SUPPLEMENTAL RESOURCES

A. *Nursery/Landscape Plant Identification Flash Cards* (116 cards)

Available from:

Vocational Agriculture Service
College of Agriculture
University of Illinois
1401 South Maryland Drive
Urbana, IL 61801
217/333-3871

B. Computer software — *Agri-Quiz: Pests and Pest Control* Study questions

C. VHS Videotape — *Pruning* (56 minutes)

B & C are available from:

Teaching Aids Incorporated
711 West 17th Street
Building E, Units 1 & 2
Costa Mesa, CA 92627
714/548-9321

D. VHS Videotape — *Elements of Pruning*

Available from:

Vocational Education Productions
California Polytechnic State University
San Luis Obispo, CA 93407
1-800/235-4146 or 805/546-2295

TEACHER SUPPLEMENT #1 — COMMON PLANTS

Common name: _____ Botanical name: _____

Size: _____ Form: _____

Hardiness zone: _____ Exposure: _____ Texture: _____

Leaves: _____ Color: _____

_____ _____

Flowers: _____ Fruit: _____

Cultural notes: _____

_____

_____

Common name: _____ Botanical name: _____

Size: _____ Form: _____

Hardiness zone: _____ Exposure: _____ Texture: _____

Leaves: _____ Color: _____

_____ _____

Flowers: _____ Fruit: _____

Cultural notes: _____

_____

_____

Common name: _____ Botanical name: _____

Size: _____ Form: _____

Hardiness zone: _____ Exposure: _____ Texture: _____

Leaves: _____ Color: _____

_____ _____

Flowers: _____ Fruit: _____

Cultural notes: _____

_____

_____

TEACHER SUPPLEMENT #1 — COMMON PLANTS

Common name: _____ Botanical name: _____

Size: _____ Form: _____

Hardiness zone: _____ Exposure: _____ Texture: _____

Leaves: _____ Color: _____

_____ _____

Flowers: _____ Fruit: _____

Cultural notes: _____

_____

_____

Common name: _____ Botanical name: _____

Size: _____ Form: _____

Hardiness zone: _____ Exposure: _____ Texture: _____

Leaves: _____ Color: _____

_____ _____

Flowers: _____ Fruit: _____

Cultural notes: _____

_____

_____

Common name: _____ Botanical name: _____

Size: _____ Form: _____

Hardiness zone: _____ Exposure: _____ Texture: _____

Leaves: _____ Color: _____

_____ _____

Flowers: _____ Fruit: _____

Cultural notes: _____

_____

_____

PLANT MATERIAL IDENTIFICATION AND PESTS
UNIT IV

INFORMATION SHEET

I. **Terms and definitions**

A. Botanical name — Latin identification of plant materials divided into genus and species; is italicized or underlined

(NOTE: The botanical name is used as the standard in the industry for precise plant selection. A plant may have several common names in different areas, but it only has one botanical name.)

B. Compound leaf — Leaf made up of several leaf-like blades attached to a central stem

C. Deciduous — Plants which loose their foliage and go dormant during the winter cold months

Examples: Maple trees, roses, crab apple trees

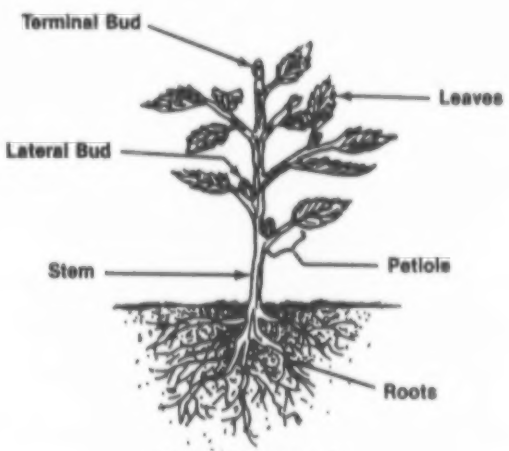
D. Dormant — Not actively growing, but capable of resuming growth when environmental conditions improve

E. Evergreen — Plants which maintain their foliage all year

Examples: Pine trees, hollies, junipers

F. Foliage — Leaves of the plant

G. Lateral bud — Bud extending from the side of a stem



Parts of a Plant

INFORMATION SHEET

H. Leaf margin — The edge of the leaf

I. Lenticel — One of the pores in the stems of woody plants by which air penetrates to the interior

(NOTE: The presence or location of the lenticel may aid in identification.)

J. Petiole — The stem of the leaf

K. Pruning — Selective cutting of plant parts

L. Terminal bud — Bud at the end of a stem

II. Characteristics used in plant identification

A. Flowers

B. Fruits

(NOTE: Flowers and fruits are good identifying characteristics because they are less subject to change by growing conditions for the plant. However, they are not always present on the plant.)

C. Leaves (including their shapes, tips, margins, types, and arrangements on the stems)

D. Stems

E. Bark

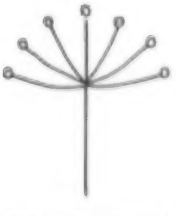
F. Overall form

III. Common flower forms

A. Single

B. Head

C. Umbel



D. Spike

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INFORMATION SHEET

E. Raceme

F. Loose cluster (panicle)

IV. Common leaf shapes

A. Deltoid (triangular)

B. Elliptic (oval)

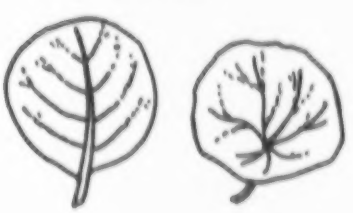
D. Linear

E. Needle-shaped

F. Oblong

G. Obovate (inverted ovate)

H. Orbicular



I. Ovate (egg-shaped)

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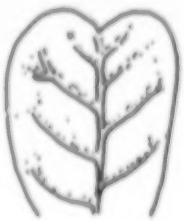
INFORMATION SHEET

V. Common leaf tips

A. Pointed

B. Rounded

C. Notched



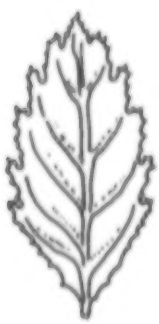
VI. Common leaf margins

A. Smooth (entire)

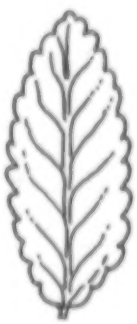
B. Wavy (undulate)

C. Serrate

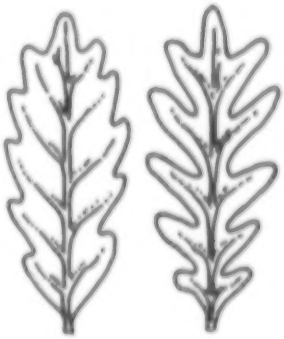
D. Dentate (double serrate)



E. Crenate



F. Lobed



Shallow Deep

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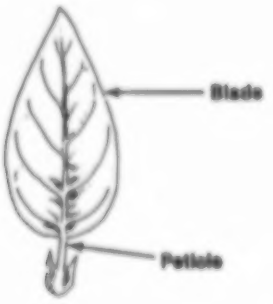
INFORMATION SHEET

VII. Basic leaf types

(NOTE: This includes the number of leaves in a grouping and how they are arranged on the petiole.)

A. Simple — One leaf blade



B. Compound leaf — Several leaf-like blades attached to the petiole

1. Pinnately compound — Leaflets attached on either side of the main petiole (like a feather)

2. Palmately compound — Leaflets radiating from one point on a single petiole (like your palm)

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INFORMATION SHEET

3. Trifoliate — Three leaflets per petiole

VIII. Leaf arrangements on a stem

A. Alternate — Leaves attached to the stem at points along the stem in an alternating form

B. Opposite — Leaves attached to the stem directly across from each other

C. Whorled — Leaves attached to the stem in a cluster around the stem

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INFORMATION SHEET

IX. How lenticels can be used as a major identifying characteristic on stems

A. Can go around the stem

B. Can go up and down the stem

C. Can be diamond shaped on the stem

D. Some plants have many, some have only a few, and some have none at all.

X. Differences in bark to use in identification

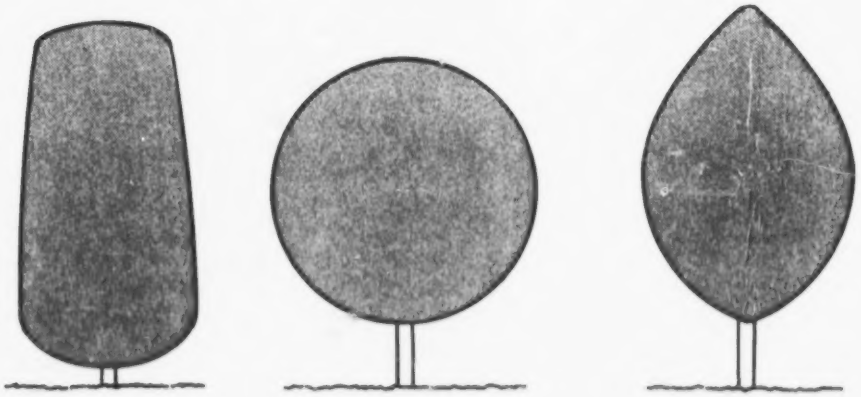
(NOTE: Often differences are only very small but can be used as an identifying characteristic to some extent.)

A. Bark **textures** can be smooth or furrowed and can have a very distinctive pattern.

B. Bark **colors** usually range from grays to browns. Unusual bark colors are very helpful in identification.

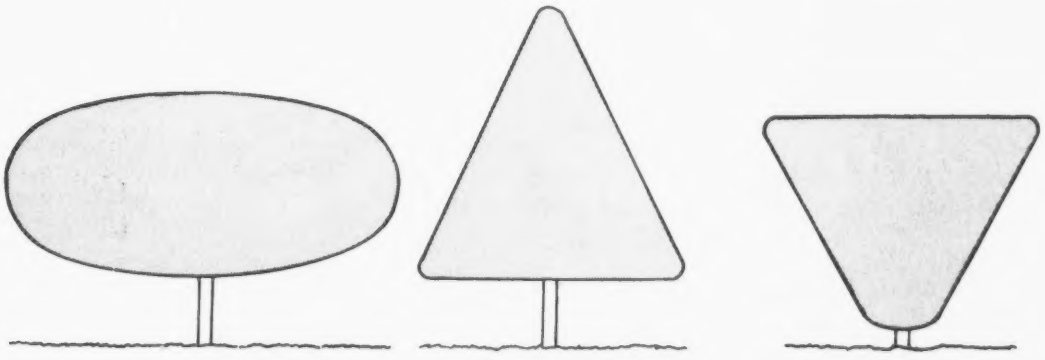
XI. Basic overall forms of plants

A. Upright B. Rounded C. Oval



INFORMATION SHEET

D. Spreading E. Pyramid F. Vase-shaped (inverted pyramid)



XII. Reasons for pruning

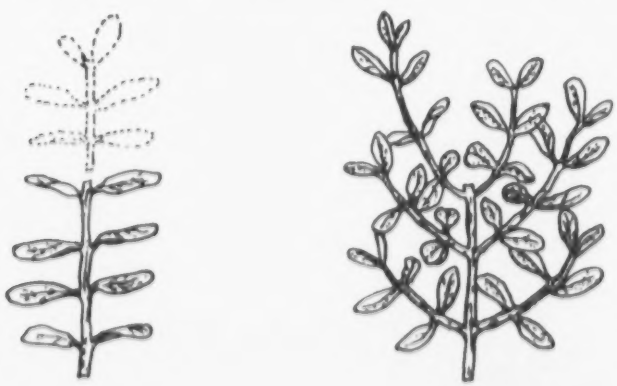
A. To remove dead, dying, diseased, or damaged plant parts

B. To manipulate the plant's growth, remove low limbs (for safety reasons), remove crossover limbs (limbs which rub against each other), and/or improve or maintain the general form or size

C. To increase flower and/or fruit production

D. Remedial pruning to prevent future damage to the plant, property, or persons nearby

E. To invigorate or rejuvenate a plant, stimulating new growth



Remove the terminal shoot to encourage buds below to grow.

INFORMATION SHEET

XIII. Pruning safety rules

A. Wear a hard hat when pruning large limbs.

B. Wear goggles as needed to protect the eyes.

C. Wear ear protection when operating loud machinery such as a chain saw.

D. Use care when operating any machinery.

E. Watch out for the cutting edge of all pruning saws when handling or using.

F. Make sure all people and animals (pets) are clear of the area before pruning.

XIV. Time to prune

(NOTE: Depending on the types of vegetation you wish to prune, different seasons are best for different trees, shrubs, and ground covers. The following are general guidelines which may need to be adjusted for your region.)

A. **Deciduous trees** — Those which lose their leaves during the fall should be pruned during the winter. Many trees can also be pruned in July because of a heat-induced dormancy. Known bleeders such as maple, elm, mulberry, and birch should be pruned in winter. To test for "bleeding," cut off a small branch two or three hours before pruning and observe any sap which will exude from the cut. If there is no exudation, it is probably safe to prune.

B. **Fruit trees and grapevines** — Should be pruned in the dead of winter. Generally speaking, the more miserable the weather, the better.

C. **Pine trees** — Should be pruned only if absolutely necessary. If the need exists, clip back the new candles as they are produced during the early spring.

D. **Spring-flowering shrubs** such as lilac, forsythia, and flowering quince — These flower on growth which is one year old. Therefore, they should be pruned after they have flowered. This will encourage more branching and the subsequent flowering the following year.

E. **Summer-flowering shrubs** such as crapemyrtle, glossy abelia, and roses — These should be pruned before the current growing season since flowers are produced on the current season's growth.

F. **Ground covers** such as vinca, honeysuckle, and monkey grass or liriope — Should be pruned before the spring flush of growth occurs.

G. **Bulbs** — Should be allowed to retain their leaves until they naturally turn yellow. The leaves of bulbs are totally responsible for the production of food (carbohydrates) used for producing the next year's flowers.

H. **Damaged plant parts** such as broken limbs caused by wind storms — Should be pruned whenever they are noticed, regardless of the time of year.

INFORMATION SHEET

XV. Insect pests and damage (Transparencies 1 and 2)

Insect Name	Color and Size	Season and Type of Damage	Symptoms/Results of Damage
A. Elm leaf beetle	Adult — Black with yellow stripes 1/4" Larvae — Black/brown 1/4"-3/8"	Summer Leaf skeletonization	Browning of foliage causing defoliation of tree.
B. Lace bug	Brown to black-gray with lacelike wings 1/8"	Summer Piercing/sucking	Mottling of the leaves with yellow specks. Black insect droppings on underside of leaves.
C. Spider mite	Yellow-brown or red 1/60"	Summer Piercing/sucking	Yellow mottling of leaves. Eggs on underside of leaf but no droppings.
D. Pine tip moth	Creamy white 1/2"	Summer Larvae burrow down candle of pine killing the candle	Candle dies back killing the new growth. Successive yearly damage will deform, stunt, and eventually kill the tree.
E. Borer	Creamy white 1/2"-1 3/4"	Spring, summer Larvae burrow under the bark circling the tree. These insects eventually girdle and kill the tree.	Usually you will notice an amber-colored wad of sap at entry or exit hole. This hole is anywhere from slightly below ground level up to first branches of the tree.
F. Tent caterpillar	Black 1/2"-1 1/4"	Summer Leaf chewing	"Tent" of webbing encases up to hundreds of larvae near branch tips. Branch tips will be totally defoliated. Web "nests" make tree unsightly.

INFORMATION SHEET

Insect Name	Color and Size	Season and Type of Damage	Symptoms/Results of Damage
G. Mealybug	White 1/8"	Spring, summer Piercing/sucking	Cottony insect is usually found on leaf petioles. They suck juices and stunt growth of plant. Severe infestations could cause death.
H. Ant	Brown, black, and red 1/8"-1/2"	Spring, summer, fall Leaf chewing	Denudes leaves and other vegetation.
I. Grasshopper	Green to brown 1"-2"	Summer Leaf chewing	Leaves chewed, causing possible defoliation of plant material.
J. Scale	White to speckled to brown 1/8"-1/4"	Spring, summer, fall Piercing/sucking	Found on limbs and twigs. Usually hard to detect. Causes weakening of trees, dying of leaves, and possibly death of plant.
K. Bagworm	Case is brown bits of leaves Case is 1"-2" long	Spring, summer, fall Leaf chewing	Bags or cocoons will be found on plant material. Left uncontrolled, these insects can kill their host plant, especially junipers.
L. Aphid (plant lice)	Yellow, green, white, black, brown 1/8"-1/5"	Spring, summer, fall Piercing/sucking	Curling and deformation of leaves. Leaves are shiny and sticky from honeydew secreted by the aphid. This honeydew usually attracts ants which feed on this sticky-sweet substance.
M. Canker worm	Brown 1"-1 1/2"	Spring, fall Leaf chewing	Defoliation of trees. Worms are suspended by a thin stringy web when shaken or blown from tree.

INFORMATION SHEET

Insect Name	Color and Size	Season and Type of Damage	Symptoms/Results of Damage
N. Whitefly	White Less than 1/16"	Spring, summer, fall Piercing/sucking	The insects excrete large amounts of "honeydew" on which sooty mold fungus grows. Plants loose vigor. When leaves are disturbed, they fly out in clouds.
O. May, June, and Japanese beetles and white grubs	Adult — Black/brown Larvae — White, C-shaped, brown head, 6 legs Larvae — 1"-1 1/2"	Spring, summer, fall Adult — Leaf chewing Larvae — Root damage	Chewed leaves and dead patches of turf. Encourages secondary damage by raccoons, skunks, and moles as they feed on this pest.
P. Billbugs and grubs	Adult — Clay colored with long snout or bill Larvae — White, orange-brown head, dark humped back, no legs Adult — 3/4" Larvae — 1/2"-3/4" 1/2"-1 1/4"	Spring, summer, fall Adult — Leaf chewing Larvae - Root damage	Chewed leaves and indefinite patterns of dead or thinning turf.

INFORMATION SHEET

XVI. Plant disease problems

Diseases	Common Host Plants	Appearance	Season
A. Fire blight	Pears, pyracantha, quince, and others	Leaves and new growth black. New shoot shows typical "shepherd's crook".	Spring Summer
B. Powdery mildew	Lilac, crape myrtles, roses, zinnias	White, powder-like appearance of leaves and stem.	Spring Summer Fall
C. Black spot	Roses	Dark circular spot on leaves of plant. Causes eventual defoliation of plant.	Spring Summer Fall
D. Dutch elm disease	American elm and certain other elms	Limbs dying in tree. Browning of vascular system. Wilting and dying of smaller branches.	Spring Summer Fall
E. Anthracnose	Sycamore, sweet gum, oak, redbud	Small triangular dead specks in leaves. Leaves can curl from this disease. Leaves' interveinal spaces turn brown and leaves drop.	Spring Summer
F. Wilts	Honeysuckle	Plant suddenly wilts, collapses, and dies.	Spring Summer
G. Blight	Junipers, etc.	Branches turn brown. Usually affected branches are scattered throughout the plant.	Spring Summer Fall
H. Canker	Many	Swelling at ground level or at base of stems or limbs.	All
I. Nematode	Many	Plants appear sickly, stunted, and yellow.	Spring Summer Fall

INFORMATION SHEET

XVII. Common plant groups

A. **Common name:** Elm — **Botanical name:** *Ulmus spp.*

Size: Large trees—40-80′ w/20-60′ spread — **Form:** Vase-shaped

Hardiness zone: 2-6 — **Exposure:** Sun — **Texture:** Fine to medium

Leaves: Simple, alternate, usually lopsided w/serrated margins — **Color:** Medium to dark green

Flowers: Not showy — **Fruit:** Small winged seed

Cultural notes: Many are susceptible to diseases and weak wood, but most will grow virtually anywhere. Extremely tough and durable. Best example is lacebark elm which is highly disease and insect resistant and tolerates parking lots, poor soil, restricted root system and soil compaction. Lacebark elm gets its name from the characteristic patches of orange bark that is exposed when outer bark peels off. Other examples are American elm and Siberian elm.

B. **Common name:** Pine — **Botanical name:** *Pinus spp.*

Size: Large trees except for dwarf varieties — **Form:** Usually pyramidial, can be loose or compact

Hardiness zone: 2-7 — **Exposure:** Sun — **Texture:** Needle-like

Leaves: Needles — **Color:** Light to deep green

Flowers: Not showy — **Fruit:** Cones

Cultural notes: Grows well in different soils, prefers a well drained soil but usually tolerates other soils except for very heavy clay. Examples are pinyon, slash, Austrian, Japanese black, Scotch, cluster, ponderosa, white, and loblolly pines.

C. **Common name:** Juniper — **Botanical name:** *Juniperus*

Size: Varies greatly — **Form:** Upright, spreading, or ground cover

Hardiness zone: 2-5 — **Exposure:** Sun — **Texture:** Fine

Leaves: Scale-like leaves — **Color:** Varies from blue-green to light or dark green

Flowers: Not showy — **Fruit:** Usually small, round bluish or purple-blue berries

Cultural notes: Most varieties are easy to grow in any type soil except very wet. Examples are Chinese, parson's, Rocky Mountain junipers, or Eastern red cedar.

INFORMATION SHEET

D. **Common name:** Holly **Botanical name:** *Ilex spp.*

Size: Small to medium shrub **Form:** Some are upright, most are rounded

Hardiness zone: 6-8 **Exposure:** Sun to part shade **Texture:** Coarse and thick

Leaves: Coarse, thick leaves with spines, broadleaf evergreen **Color:** Varies from blue-green to deep green

Flowers: Not showy **Fruit:** Most have red berries

Cultural notes: Grow well in most landscapes, but don't like poor drainage, or hot, dry wind. Examples are burford, blue, Japanese, Chinese, yaupon, Foster's, "Nellie R. Stevens", and American hollies.

E. **Common name:** Maple **Botanical name:** *Acer spp.*

Size: Some are small, most medium to large trees **Form:** Mostly rounded or oval

Hardiness zone: 2-5 **Exposure:** Sun to part shade **Texture:** Medium

Leaves: Simple, opposite, usually deeply lobed with a coarsely toothed margin **Color:** Medium to dark green; good fall colors

Flowers: Not showy **Fruit:** Flattened, winged seeds

Cultural notes: Most species grow well in a wide variety of soils if adequate water is given. Attractive trees that are used often in landscapes. Examples are trident, hedge, amur, paperbark, Japanese, Norway, red, river, and sugar maples and boxelder.

F. **Common name:** Red oak **Botanical name:** *Quercus spp.*

Size: Large trees—60-100' w/30-60' spread **Form:** Pyramidal to oval

Hardiness zone: 3-8 **Exposure:** Sun **Texture:** Medium

Leaves: Simple, bristle-tipped lobes or the tip of the leaf terminates in a single bristle **Color:** Leaves are deep, dark green. Bark is generally dark gray to gray-black, is smooth when young, and hard and rigid when mature but not flaky.

Flowers: Not showy **Fruit:** Acorns take 2 seasons to mature and taste bitter

Cultural notes: Pores in the wood are open and do not hold water. Grows well in urban areas with fair to good soil. Can be transplanted in late fall, winter, or early spring. Examples are Northern and Southern red, blackjack, sawtooth, water, pin, willow, and shumard oaks.

INFORMATION SHEET

G. **Common name:** White oak **Botanical name:** *Quercus spp.*

Size: Large trees—60-100′ w/40-60′ spread **Form:** Rounded

Hardiness zone: 3-4 **Exposure:** Sun **Texture:** Medium to coarse depending on species

Leaves: Simple, rounded at the tips with no sharp bristles or points **Color:** Leaves are deep green to slightly blue-green. Bark is light gray or brown and becomes scaly or flaky.

Flowers: Not showy **Fruit:** Acorns mature in a single season and are generally sweet to the taste

Cultural notes: The wood has pores that are plugged with a plastic-like material called tylose. This makes the wood valuable for making barrels which are capable of holding water or other liquids. Needs fair to good soil with a moderate supply of moisture. Examples are white, swamp white, bur, chinquapin, English, and post oaks.

(NOTE: Hardiness zones vary depending on the specific species. For example, one species of maple may tolerate zone 2 while another species may only tolerate zone 5.)

Insect Pests

Ants

Aphids

Beetles

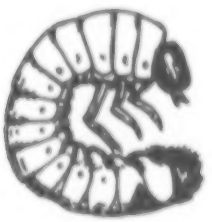
Borers

Caterpillars

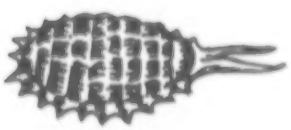
Cutworms

Insect Pests
(Continued)

Grasshoppers



Grubs



Mealybugs

Mites

Scale

Whiteflies

PLANT MATERIAL IDENTIFICATION AND PESTS
UNIT IV

ASSIGNMENT SHEET #1 — IDENTIFY CHEMICAL TREATMENTS FOR INSECT PESTS

NAME _____ SCORE _____

Directions: Using an insect chemical chart provided by your instructor, answer the following questions.

1. What chemicals can be used to control ants?

   _____

2. What conditions favor the build-up of millipedes?

   _____

3. Should orthene be applied to American elms to control elm leaf beetle?

   _____

4. What is *Bacillus thuringiensis*?

   _____

5. When is pine tip moth damage most prevalent?

   _____

6. What chemicals can be used for whiteflies?

   _____

7. What chemicals can be used for thrips?

   _____

8. What is "honeydew"?

   _____

9. When should chemical applications for bagworms begin?

   _____

10. What chemicals can be used for grasshoppers?

    _____

ASSIGNMENT SHEET #1

11. What plants do lace bugs commonly attack?

_____

12. When should dormant oil be applied?

_____

PLANT MATERIAL IDENTIFICATION AND PESTS
UNIT IV

ASSIGNMENT SHEET #2 — IDENTIFY CHEMICAL TREATMENTS FOR PLANT DISEASES

NAME _____ SCORE _____

Directions: Using a chemical chart for plant diseases provided by your instructor, answer the following questions.

1. What is the treatment for fire blight?

   _____

2. What are the symptoms of powdery mildew?

   _____

3. What is the treatment for twig or phomopsis blight?

   _____

4. What disease is the chemical benlate used for?

   _____

5. What is arbotect?

   _____

6. What is the chemical treatment for wilt?

   _____

7. What is canker?

   _____

8. What crop does black spot attack?

   _____

9. What chemical is used on powdery mildew?

   _____

10. What chemical is used for canker?

    _____

11. What is the treatment for anthracnose?

    _____

12. What crop does anthracnose attack?

    _____

PLANT MATERIAL IDENTIFICATION AND PESTS
UNIT IV

ASSIGNMENT SHEET #3 — IDENTIFY SPECIFIC PLANTS

NAME _____ SCORE _____

Directions: Collect samples of common plants in your area. Preserve these in wax paper and label them accordingly. Complete a report explaining the identifying characteristics you used to identify the plants in your display.

PLANT MATERIAL IDENTIFICATION AND PESTS
UNIT IV

ASSIGNMENT SHEET #4 — LIST LOCAL PLANTS

NAME _____ SCORE _____

Directions: Develop a list of twenty (20) plants which are native or most common in your area. Compare these lists with other students and the teacher to come up with a new list.

PLANT MATERIAL IDENTIFICATION AND PESTS
UNIT IV

ASSIGNMENT SHEET #5 — IDENTIFY SPECIFIC PLANT DISEASES

NAME _____ SCORE _____

Directions: Either as a group or individually find a sample of a disease on a plant. Each member of the group should write a report explaining what disease problem they think the sample is showing and why. Also include treatment for the problem. Then ask the teacher to show you how to send the sample to the lab for confirmation of your diagnosis.

PLANT MATERIAL IDENTIFICATION AND PESTS
UNIT IV

ASSIGNMENT SHEET #6 — IDENTIFY SPECIFIC INSECT PESTS

NAME _____ SCORE _____

Directions: Find samples of two (2) insect pests described in this unit. Tell what characteristics you used to make your identification. Explain what treatment you would use if you found an infestation on your plant materials.

PLANT MATERIAL IDENTIFICATION AND PESTS
UNIT IV

JOB SHEET #1 — PRUNE BRANCHES

A. Tools and equipment

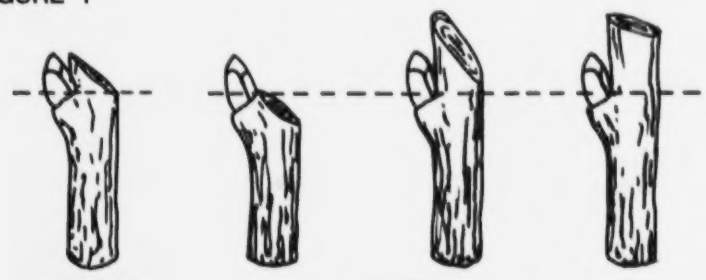
1. Hand pruners
2. Loppers
3. Bow saw
4. Pole saw
5. Pole loppers
6. Hedge trimmers
7. Wound dressing
8. Tree wrap
9. Safety equipment as needed (gloves, hard hats, eye and ear protection)

B. Procedure

1. Assemble the needed tools and equipment and carry to the site where pruning is to be done.
2. Put on safety equipment and follow all safety rules.
3. Make the smallest cut possible, but do *not* leave a stub.

   (NOTE: Stubs harbor insects and diseases and will increase the likelihood of the tree contracting heart rot later.)

FIGURE 1



Lowest point of cut should be even with bud and slant upward at a 45° angle.

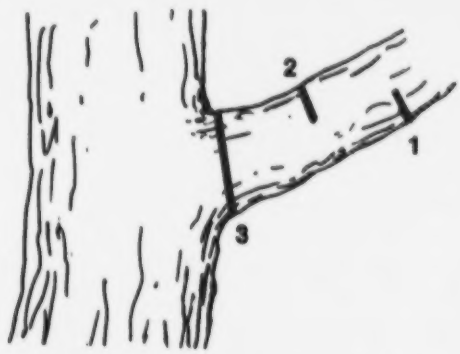
JOB SHEET #1

4. Make bevel cuts on evergreen shrubs to hide the end of the cut branch. This is done by sloping the cut towards the underside of the branch.

FIGURE 2

5. Use a jump cut on tree limbs larger than 3 inches. This will keep the weight of the limb from peeling the bark from the trunk of the tree as the limb breaks at the cut.

FIGURE 3



a. Cut #1 should be made upward from the bottom of the branch until the weight of the branch binds the saw.

b. Cut #2 should be made next by sawing downward. The limb will break from the top of cut #1 to the bottom of cut #2 leaving a stub.

c. Cut #3 is the final cut, removing the stub from the trunk of the tree.

(NOTE: Notice that the limb collar or "swelling" of the branch is left attached to the trunk. By removing the swelling (which is unnecessary) the wound will be larger than necessary.)

6. Paint cut surface with a wound dressing.

7. Dispose of pruned debris.

8. Return tools and equipment to the storage area, and put away properly.

PLANT MATERIAL IDENTIFICATION AND PESTS
UNIT IV

JOB SHEET #2 — TREAT TREE INJURY WOUNDS

A. Tools and equipment

1. Hand pruners
2. Loppers
3. Bow saw
4. Pole saw
5. Pole loppers
6. Hedge trimmers
7. Wound dressing
8. Tree wrap
9. Safety equipment as needed (gloves, hard hats, eye and ear protection)

B. Procedure

(NOTE: Injuries to the trunks of trees are quite common. Left untreated, serious damage may occur, leading to the death of the tree by borer attack or by heart rot organisms weakening the trunk. Particular attention must be made in cleaning and shaping the wound prior to applying the dressing.)

1. Shape the wound so that it is elliptical or "canoe-shaped".

   (NOTE: This helps rainwater to escape from the wound, decreasing the chance of heart rot.)

   FIGURE 1

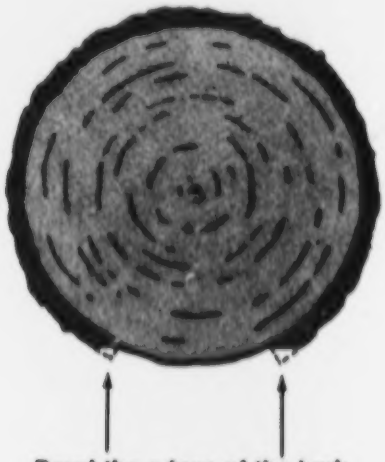
Elliptical-Shaped Wound

JOB SHEET #2

2. Bevel the bark at the sides of the wound so that when the bark starts to cover the wound, it will not "roll" and curl over itself.

   (NOTE: The bark and underlying cambial layer will only grow from side to side, gradually covering the exposed heartwood.)

   FIGURE 2



Bevel the edges of the bark around the perimeter of the wound.

3. Paint the wound with a wound dressing to repel water and borers and to discourage rabbits and other wildlife from causing further damage by chewing.

   (CAUTION: Do not use roofing tar, housepaint, or any material not specifically intended for use on plant materials.)

4. Dispose of pruned debris.

5. Return tools and equipment to the storage area, and put away properly.

PLANT MATERIAL IDENTIFICATION AND PESTS
UNIT IV

PRACTICAL TEST
JOB SHEET #1 — PRUNE BRANCHES

STUDENT'S NAME _____ DATE _____

EVALUATOR'S NAME _____ ATTEMPT NO. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

(EVALUATOR NOTE: Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.)

The student:	YES	NO
1. Checked out proper tools and materials.	_____	_____
2. Used proper equipment for the type of pruning done.	_____	_____
3. Properly pruned branches.	_____	_____
4. Painted wound appropriately.	_____	_____
5. Disposed of debris.	_____	_____
6. Returned tools to their proper places.	_____	_____
7. Practiced safety rules throughout procedure.	_____	_____

EVALUATOR'S COMMENTS: _____

_____

JOB SHEET #1 PRACTICAL TEST

PRODUCT EVALUATION

(EVALUATOR NOTE: Rate the student on the following criteria by circling the appropriate numbers. Each item must be rated at least a "3" for mastery to be demonstrated. (See performance evaluation key below.) If the student is unable to demonstrate mastery, student materials should be reviewed and another product must be submitted for evaluation.)

Criteria:

Smallest cut made	4	3	2	1
No stub left	4	3	2	1
No bark tearing	4	3	2	1
No damage to nearby branches	4	3	2	1

EVALUATOR'S COMMENTS: _____

_____

PERFORMANCE EVALUATION KEY
4 — Skilled — Can perform job with no additional training. 3 — Moderately skilled — Has performed job during training program; limited additional training may be required. 2 — Limited skill — Has performed job during training program; additional training is required to develop skill. 1 — Unskilled — Is familiar with process, but is unable to perform job.

(EVALUATOR NOTE: If an average score is needed to coincide with a competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria.)

PLANT MATERIAL IDENTIFICATION AND PESTS
UNIT IV

PRACTICAL TEST
JOB SHEET #2 — TREAT TREE INJURY WOUNDS

STUDENT'S NAME _____ DATE _____

EVALUATOR'S NAME _____ ATTEMPT NO. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

(EVALUATOR NOTE: Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.)

The student:	YES	NO
1. Checked out proper tools and materials.	_____	_____
2. Used proper equipment for the type of pruning done.	_____	_____
3. Shaped wound as needed.	_____	_____
4. Treated the wound appropriately.	_____	_____
5. Disposed of debris.	_____	_____
6. Returned tools to their proper places.	_____	_____
7. Practiced safety rules throughout procedure.	_____	_____

EVALUATOR'S COMMENTS: _____

_____

JOB SHEET #2 PRACTICAL TEST

PRODUCT EVALUATION

(EVALUATOR NOTE: Rate the student on the following criteria by circling the appropriate numbers. Each item must be rated at least a "3" for mastery to be demonstrated. (See performance evaluation key below.) If the student is unable to demonstrate mastery, student materials should be reviewed and another product must be submitted for evaluation.)

Criteria:				
Wound is elliptical or "canoe-shaped"	4	3	2	1
Bark is beveled	4	3	2	1
Appropriate wound dressing used	4	3	2	1

EVALUATOR'S COMMENTS: _____

_____

PERFORMANCE EVALUATION KEY
4 — Skilled — Can perform job with no additional training. 3 — Moderately skilled — Has performed job during training program; limited additional training may be required. 2 — Limited skill — Has performed job during training program; additional training is required to develop skill. 1 — Unskilled — Is familiar with process, but is unable to perform job.

(EVALUATOR NOTE: If an average score is needed to coincide with a competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria.)

PLANT MATERIAL IDENTIFICATION AND PESTS
UNIT IV

TEST

NAME _____ SCORE _____

1. Match the terms on the right with the correct definitions.

_____a.	The stem of the leaf	1. Botanical name
_____b.	One of the pores in the stems of woody plants by which air penetrates to the interior	2. Compound leaf
_____c.	Plants which loose their foliage and go dormant during the winter cold months	3. Deciduous
_____d.	Leaf made up of several leaf-like blades attached to a central stem	4. Dormant
_____e.	Plants which maintain their foliage all year	5. Evergreen
_____f.	The edge of the leaf	6. Foliage
_____g.	Latin identification of plant materials divided into genus and species; is italicized or underlined	7. Lateral bud
_____h.	Leaves of the plant	8. Leaf margin
_____i.	Not actively growing, but capable of resuming growth when environment conditions improve	9. Lenticel
_____j.	Bud extending from the side of a stem	10. Petiole
_____k.	Selective cutting of plant parts	11. Pruning
_____l.	Bud at the end of a stem	12. Terminal bud

2. Name five characteristics used in plant identification.

a. _____

b. _____

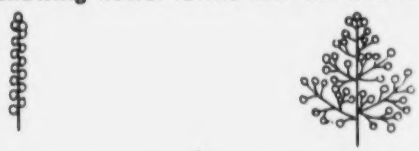
c. _____

d. _____

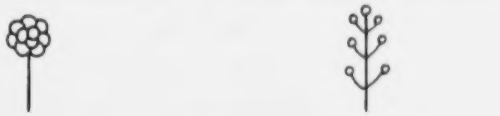
e. _____

TEST

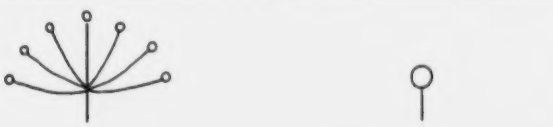
3. Match the following flower forms with the correct illustrations.



a. _____ b. _____



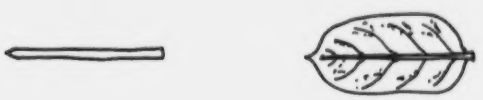
c. _____ d. _____



e. _____ f. _____

1. Single
2. Head
3. Umbel
4. Spike
5. Raceme
6. Loose cluster

4. Match the leaf shapes with the correct illustrations.



a. _____ b. _____

c. _____ d. _____

e. _____ f. _____

1. Deltoid
2. Elliptic (oval)
3. Linear
4. Needle-shaped
5. Oblong
6. Obovate
7. Orbicular
8. Ovate

TEST

5. Match the leaf tips with the correct illustrations.

a. _____

b. _____

c. _____

1. Pointed
2. Rounded
3. Notched

6. Match the leaf margins with the correct illustrations.

a. _____

b. _____

c. _____

d. _____

1. Dentate
2. Lobed
3. Wavy
4. Smooth
5. Serrate
6. Crenate

TEST

e. _____ f. _____

7. Match the leaf types with the correct illustrations.

1. Pinnately compound
2. Simple
3. Palmately compound
4. Trifoliate

a. _____ b. _____

c. _____ d. _____

8. Match the leaf arrangements on the stems with the correct illustrations.

1. Alternate
2. Whorled
3. Opposite

a. _____ b. _____ c. _____

TEST

9. Explain how a lenticel can be used in identification.

_____

_____

_____

10. Name two differences that can be seen in bark that help in identification.

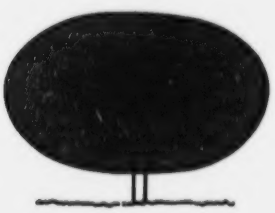
a. _____

b. _____

11. Identify the following overall forms of plants.

a. _____

b. _____



c. _____

d. _____

12. Name two reasons for pruning.

a. _____

b. _____

TEST

13. List three safety rules you should follow when pruning.

    a. _____

    b. _____

    c. _____

14. Match the appropriate times for pruning for the plants listed below.

_____a.	Deciduous trees	1. Summer
_____b.	Spring-flowering shrubs such as lilac and forsythia	2. Fall
_____c.	Fruit trees and grapevines	3. Winter
_____d.	Bulbs	4. Anytime
_____e.	Ground covers such as liriope	5. Never
_____f.	Summer-flowering shrubs such as roses	6. After leaves have yellowed
_____g.	Dead and broken limbs	7. Before current growing season begins
		8. After flowering

TEST

15. Complete the following chart on insect pests.

Insect Name	Color	Size	Symptoms/ Results of Damage
• Elm leaf beetle	Adult - a. _____	Adult - 1/4"	b. _____ _____
• Lace bug	c. _____ _____	1/8"	Mottling of the leaves with yellow specks.
• Spider mite	Yellow-brown or red	d. _____	Yellow mottling of leaves.
• Pine tip moth	Creamy white	1/2"	e. _____ _____ _____
• Borers	Creamy white	1/2" - 1 3/4"	f. _____ _____ _____
• Tent caterpillar	Black	1/2" - 1 1/4"	g. _____ _____
• Mealybug	h. _____	i. _____	Sucks juices and stunts growth of plant. Could cause death.
• Ants	j. _____ _____	1/8" - 1/2"	Denudes leaves and other vegetation.
• Scale	White to speckled to brown	k. _____	Causes weakening of trees, dying of leaves, and possibly death of plant.
• Grasshoppers	l. _____ _____	1" - 2"	Leaves chewed, causing possible defoliation of plant material.
• Bagworm	m. _____ _____	Case is 1" - 2" long	Bags found on plant material. Can kill the host plants.
• Aphids	Yellow, green, white, brown, black	n. _____	Curling and deformation of leaves. Sticky secretion on leaves.

TEST

16. Complete the following chart on plant disease problems

Diseases	Host Plant(s)	Appearance
• a. _____	Pears, pyracantha, quince, and others	Leaves and new growth black. New shoot shows typical "shepherd's crook".
• Powdery mildew	Lilac, crapemyrtles, roses, zinnias	b. _____ _____
• Black spot	c. _____	Dark circular spot on leaves of plant. Causes eventual defoliation of plant.
•d. _____	American elm and certain other elms	Limbs dying in tree. Browning of vascular system. Wilting and dying of smaller branches.
•e. _____	Sycamore, sweet gum, oak, redbud	Small triangular dead specks in leaves. Leaves can curl from this disease. Leaves' interveinal spaces turn brown and drop.
• f. _____	Honeysuckle	Plant suddenly wilts, collapses, and dies.
• Blight	Junipers, etc.	g. _____ _____
• Canker	Many	h. _____ _____
• Nematode	Many	i. _____ _____

TEST

17. Complete the following chart on plant groups.

Common name: a. _____ **Botanical name:** *Ulmus spp.*

Size: Large trees—40-80′ w/20-60′ spread **Form:** Vase-shaped

Hardiness zone: 2-6 **Exposure:** Sun **Texture:** Fine to medium

Leaves: Simple, alternate, usually lopsided w/serrated margins **Color:** Medium to dark green

Flowers: Not showy **Fruit:** Small winged seed

Common name: Pine **Botanical name:** b. _____

Size: Large trees except for dwarf varieties **Form:** Usually c. _____, can be loose or compact

Hardiness zone: 2-7 **Exposure:** Sun **Texture:**

Leaves: Needles **Color:** Light to deep green

Flowers: Not showy **Fruit:** d. _____

Common name: Juniper **Botanical name:** *Juniperus*

Size: Varies greatly **Form:** Upright, spreading, or ground cover

Hardiness zone: 2-5 **Exposure:** e. _____ **Texture:** f. _____

Leaves: Scale-like leaves **Color:** Varies from blue-green to light or dark green

Flowers: Not showy **Fruit:** Usually small, round bluish or purple-blue berries

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Common name: g. _____ **Botanical name:** *Quercus spp.*

Size: Large trees—60-100′ w/40-60′ spread **Form:** Rounded

Hardiness zone: 3-4 **Exposure:** Sun **Texture:** Medium to coarse

Leaves: Simple, rounded at the tips with no sharp bristles or points **Color:** Leaves are deep green to slightly blue-green. Bark is light gray or brown and becomes scaly or flaky.

Flowers: Not showy **Fruit:** Acorns mature in a single season and are generally sweet to the taste

---

TEST

Common name: h. _____ **Botanical name:** *Quercus spp.*

Size: Large trees—60-100' w/30-60' spread **Form:** Pyramidal to oval

Hardiness zone: 3-6 **Exposure:** Sun **Texture:** Medium

Leaves: Simple, bristle-tipped lobes or the tip of the leaf terminates in a single bristle **Color:** Leaves are deep, dark green. Bark is generally dark gray to gray-black, is smooth when young, and hard and rigid when mature but not flaky.

Flowers: Not showy **Fruit:** Acorns take 2 seasons to mature and taste bitter

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(NOTE: If the following activities have not been accomplished prior to the test, ask your instructor when the should be completed.)

18. Identify chemical treatments for insect pests. (Assignment Sheet #1)
19. Identify chemical treatments for plant diseases. (Assignment Sheet #2)
20. Identify specific plants. (Assignment Sheet #3)
21. List local plants. (Assignment Sheet #4)
22. Identify specific plant diseases. (Assignment Sheet #5)
23. Identify specific insect pests. (Assignment Sheet #6)
24. Demonstrate the ability to:
    a. Prune branches. (Job Sheet #1)
    b. Treat tree injury wounds. (Job Sheet #2)

PLANT MATERIAL IDENTIFICATION AND PESTS
UNIT IV

ANSWERS TO TEST

1.
a.	10	f.	8	k.	11
b.	9	g.	1	l.	12
c.	3	h.	6		
d.	2	i.	4		
e.	5	j.	7		

2. Any five of the following:

   a. Flowers
   b. Fruit
   c. Leaves
   d. Stems
   e. Bark
   f. Overall form

3.
a.	4	d.	5
b.	6	e.	3
c.	2	f.	1

4.
   a. 4
   b. 5
   c. 1
   d. 8
   e. 7
   f. 3

5.
   a. 3
   b. 1
   c. 2

6.
a.	4	d.	1
b.	3	e.	6
c.	5	f.	2

7.
   a. 1
   b. 2
   c. 4
   d. 3

ANSWERS TO TEST

8. a. 2
   b. 3
   c. 1

9. Explanation should include:

   They have differences which can be used to identify plants. Some plants have many, some have a few, and some have none. They can go around the stem, up and down the stem, or are diamond shaped.

10. a. Textures
    b. Colors

11. a. Pyramid
    b. Rounded
    c. Spreading
    d. Upright

12. Any two of the following:

    a. To remove dead, dying, diseased, or damaged plant parts
    b. To manipulate the plant's growth, remove low limbs, remove crossover limbs, and/or improve or maintain the general form or size
    c. To increase flower and/or fruit production
    d. Remedial pruning to prevent future damage to the plant, property, or persons nearby
    e. To invigorate or rejuvenate a plant, stimulating new growth

13. Any three of the following:

    a. Wear a hard hat when pruning large limbs.
    b. Wear goggles as needed to protect the eyes.
    c. Wear ear protection when operating loud machinery such as a chain saw.
    d. Use care when operating any machinery.
    e. Watch out for the cutting edge of all pruning saws when handling or using.
    f. Make sure all people and animals are clear of the area before pruning.

14. a. 3
    b. 8
    c. 3
    d. 6
    e. 7
    f. 7
    g. 4

ANSWERS TO TEST

15. a. Black with yellow stripes
    b. Browning of foliage causing defoliation of tree
    c. Brown to black-gray with lacelike wings
    d. 1/50"
    e. Candles die back killing new growth. Can deform, stunt, and eventually kill the tree
    f. Amber-colored wad of sap at entry or exit hole
    g. Tent of webbing encases up to hundreds of larvae near branch tips. Branch tips will be totally defoliated. Unsightly
    h. White
    i. 1/8"
    j. Brown, black, or red
    k. 1/8" - 1/4"
    l. Green to brown
    m. Case is brown bits of leaves
    n. 1/8" - 1/5"

16. a. Fire blight
    b. White, powder-like appearance of leaves and stem
    c. Roses
    d. Dutch elm disease
    e. Anthracnose
    f. Wilts
    g. Branches turn brown
    h. Swelling at ground level or at base of stems or limbs
    i. Plants appear sickly, stunted, and yellow

17. a. Elm
    b. *Pinus spp.* (Should be underlined)
    c. Pyramidal
    d. Cones
    e. Sun
    f. Fine
    g. White oak
    h. Red oak

18.-23. Evaluated to the satisfaction of the instructor

24. Performance skills evaluated to the satisfaction of the instructor

TURF IDENTIFICATION AND PESTS
UNIT V

UNIT OBJECTIVE

After completion of this unit, the student should be able to complete charts on identification, characteristics, maintenance, and control of common turf grasses, insects, weeds, and diseases. Competencies will be demonstrated by completing the assignment sheets, job sheets, and the unit tests with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms related to turf identification and pests with the correct definitions.
2. Complete statements concerning soil pH.
3. Distinguish between major and minor turfgrass nutrients.
4. Complete a chart on cool season grasses.
5. Complete a chart on warm season grasses.
6. State the hardiness zone where you live and what grasses grow there.
7. Name the questions that should be asked when trying to determine proper turf selection.
8. Complete a chart on common turf insect pests.
9. Complete a chart on common turf weed problems.

OBJECTIVE SHEET

10. Complete a chart on common turf diseases.

11. Select appropriate grasses for various conditions and zones. (Assignment Sheet #1)

12. Locate and describe local turf insects. (Assignment Sheet #2)

13. Locate and describe local turf weeds. (Assignment Sheet #3)

14. Describe symptoms for various turf diseases. (Assignment Sheet #4)

15. Answer questions using a chemical control chart provided by instructor. (Assignment Sheet #5)

16. Demonstrate the ability to:

    a. Seed a lawn using a hydromulcher. (Job Sheet #1)

    b. Overseed a lawn using a seeder. (Job Sheet #2)

    c. Sprig a lawn using a tractor tiller. (Job Sheet #3)

    d. Use a drop-type fertilizer spreader. (Job Sheet #4)

    e. Use a broadcast or rotary-type fertilizer spreader. (Job Sheet #5)

TURF IDENTIFICATION AND PESTS
UNIT V

SUGGESTED ACTIVITIES

A. Obtain additional materials and/or invite resource people to class to supplement/reinforce information provided in this unit of instruction.

(NOTE: This activity should be completed prior to the teaching of this unit.)

B. Make transparencies from the transparency masters included with this unit.

C. Provide students with objective sheet.

D. Discuss unit and specific objectives.

E. Provide students with information and assignment sheets.

F. Discuss information and assignment sheets.

(NOTE: Use the transparencies to enhance the information as needed.)

G. Provide students with job sheets.

H. Discuss and demonstrate the procedures outlined in the job sheets.

I. Integrate the following activities throughout the teaching of this unit:

1. Review procedure for installing turf using various methods — seed, sod, sprigs, plugs. These methods were covered in MAVCC's *Landscape Management: Field Operator*, Unit VI.

2. Show the use, calibration, and care of the two types of fertilizer spreaders.

3. Collect and preserve samples of the lawn grasses mentioned in this unit.

4. Discuss and show examples of cultivars of local grasses.

5. Review procedure for dethatching a lawn.

6. Take a soil sample to determine fertilization needs.

7. Take a field trip to an area where a maintenance program is being used on turf.

   Examples: Golf course, university, sod producer

8. Collect and preserve samples of common insect pests described in this unit.

9. Visit a chemical supplier for additional information on chemicals.

SUGGESTED ACTIVITIES

10. Collect and preserve samples of common weeds described in this unit.

11. Take a field trip to look for visible signs of diseases on turf areas.

J. Give test.

K. Evaluate test.

L. Reteach if necessary.

RESOURCES USED IN DEVELOPING THIS UNIT

A. *Scotts Information Manual for Lawns and Gardens*. Marysville, OH: O.M. Scott and Sons Company, 1977.

B. Hartzler, R.G. *Lawn Weed Control*. Ames, IA: Iowa State University Coop Extension Service, 1985.

C. Agnew, Michael. Ames, IA: Iowa State University Coop Extension Service.
1. *Thatch Control in the Home Lawn* (1986)
2. *Calibration and Maintenance of a Fertilizer Spreader and Lawn Area Calculation.*
3. *Mowing Your Lawn* (1985).

D. Hummel, Norm. Ames, IA: Iowa State University Coop Extension Service.
1. *Maintenance Fertilization of Turfgrasses* (1985).
2. *Establishing a Lawn From Seed* (1985).
3. *Turfgrass Renovation* (1985).
4. *Turfgrass Management Calendar: Kentucky Bluegrass Lawns* (1985).
5. *Which Grass is Best for Your Lawn?* (1985).

E. *Extension Agents Handbook*. Cooperative Extension Service, Stillwater, OK: Oklahoma State University

SUGGESTED SUPPLEMENTAL RESOURCES

A. Slide films or slide sets with study guides

1. *Lawn Weeds — Identification and Control*

2. *Steps to a Better Lawn*

Available from:

Vocational Agriculture Service
College of Agriculture
University of Illinois
1401 South Maryland Drive
Urbana, IL 61801
217/333-3871

RESOURCES USED IN DEVELOPING THIS UNIT

B. VHS Videotapes

1. *Lawn Care* (48 minutes)

2. *Ground Covers* (60 minutes)

C. Computer Software — *Agri-Quiz: Turf & Groundcovers* study questions

B&C are available from:

Teaching Aids Incorporated
711 West 17th Street
Building E, Units 1 & 2
Costa Mesa, CA 92627
714/548-9321

TURF IDENTIFICATION AND PESTS
UNIT V

INFORMATION SHEET

I. **Terms and definitions**

A. Dicots — Plants that germinate from the seed with two seedling leaves; these plants have a characteristic of veins that form a net-like pattern

Examples: Dandelion, clover, henbit

Courtesy O.M. Scott and Sons
Marysville, Ohio

B. Drought — Damaging climatic conditions brought about by heat and a lack of rainfall

C. Environmental stress — Stress caused by naturally occurring factors such as drought, sunlight, or too much rainfall

D. Fungicide — A material used in controlling fungi which attack plants and leaves

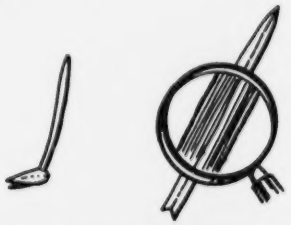
E. Herbicide — A material used in controlling weeds on lawns or in other areas

F. Insecticide — A material used to control insects on desirable plants

G. Local adaptation — Whether or not a plant will grow in a particular geographical region

H. Monocots — Plants that germinate from the seed with a single seedling leaf; these plants have a characteristic of veins that run parallel to each other

Examples: All grasses



Courtesy O.M. Scott and Sons
Marysville, Ohio

INFORMATION SHEET

I. Nonselective herbicide — A herbicide which kills every species of plant which it contacts

J. Postemergence herbicide — A herbicide which kills after contacting leaves of the plant

K. Preemergence herbicide — A herbicide which kills weeds as they germinate from the seed

L. Selective herbicide — A herbicide which kills only certain species of plants

M. Surface feeding insects — Insects that do damage to plants by chewing or sucking on the part of the plant above the ground

N. Thatch — A tight layer of dead and living stems, leaves, and roots that forms between the soil surface and green vegetation

(NOTE: Thatch development is normal; however, excessive amounts of thatch may be detrimental to the health of the lawn.)

O. Turf disease — A naturally-occurring disease of a lawn usually caused by a fungus; very dependent on environmental temperature and humidity and cultural practices (fertilization, watering, mowing, and thatch buildup)

P. Turf pest — Anything which damages turf

Examples: Dogs, weeds, diseases, insects, humans, gophers, moles, even gasoline spilled on a lawn

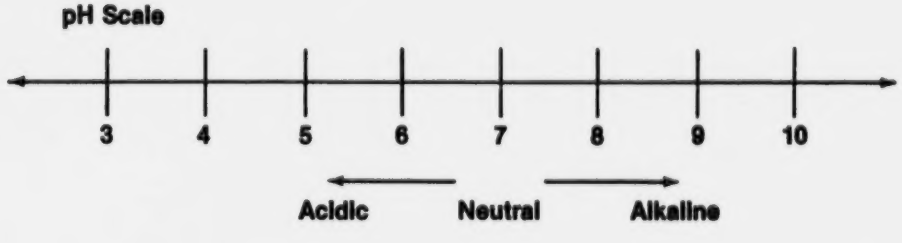
Q. Underground feeding insects — Insects that do damage to plants by chewing the roots

R. Winter kill — Damage caused by freezing temperatures, or a combination of cold temperatures and lack of moisture

II. Soil pH

A. pH is an abbreviation for "potential hydrogen." It indicates the alkalinity or acidity of the soil.

B. The pH scale ranges from 0 to 14 with 7 being neutral, below 7 acidic, and above 7 alkaline



INFORMATION SHEET

C. A pH of 6.0 - 6.5 is desirable for most turfgrasses. However, many turfgrasses can tolerate a lower pH. When pH goes above 7, minor elements (especially iron) can become deficient which affects turf health.

D. Soil tests will give an analysis of the soil nutrients present as well as the soil's pH.

E. Soil amendments may be used to change the soil pH or condition.

1. Sulfur — Used to lower the soil pH
2. Lime — Used to raise the soil pH
3. Gypsum — Calcium sulfate, a naturally-occurring mineral, which conditions heavy clay soils by making the clay particles clump together creating needed air spaces in the soil.

III. Turfgrass nutrients

A. Major nutrients

1. Nitrogen (N) — The first nutrient represented in a fertilizer analysis; responsible for growth of above ground plant parts and for the development of chlorophyll, utilized in the development of plants and the green color of turf

   (NOTE: Turfgrasses use large quantities of nitrogen which should be regularly replaced for a healthy turf.)

2. Phosphorus (P) — The second major nutrient represented in a fertilizer analysis; utilized by the plant for root growth and seed and fruit production; fairly stable in the soil

3. Potassium (K) (potash) — The third and last major nutrient represented in a fertilizer analysis; utilized mostly by the plant for disease resistance; fairly stable in the soil

Fertilizer Analysis

33 - 0 - 0	26 - 10 - 3	5 - 10 - 10
↑ ↑ ↑	↑ ↑ ↑	↑ ↑ ↑
N P K	N P K	N P K

INFORMATION SHEET

B. Minor nutrients

(NOTE: These nutrients are needed by the plant in very small quantities but are of major importance nevertheless. Most minor nutrients are available in sufficient quantities in the soil, although a soil analysis may detect deficiencies which need to be supplemented.)

1. Calcium
2. Sulphur
3. Zinc
4. Copper
5. Mag[illegible]ium
6. Manganese
7. Boron
8. Molybdenum
9. Iron

(NOTE: When there is insufficient or unavailable iron in the soil, the turfgrass cannot produce enough chlorophyll which causes a yellowing of the grass blades. This condition is known as iron chlorosis. Supplemental iron must be applied at regular intervals to correct this condition.)

IV. **Cool season grasses** (Transparency 1)

(NOTE: When planting cool season grass, it is very common to mix different types of grasses. This serves many purposes, such as aiding in germination of less vigorous types, giving a more-uniform coverage, and allowing for cover during different seasons due to the ability of some types to perform better during different times of the year. Types of grass in mixture can contain different varieties of bluegrass, rye, and fescue.)

A. Fescue

1. Identification — Fine fescues are medium green in color and spread by tillers of short creeping rhizomes. Tall fescues are medium to dark green in color and have coarse blades. Turf is often open and doesn't form a closely knit lawn.
2. Use — Tall fescue is often used where a low maintenance lawn is desired. It is used in cooler regions of the U.S. and in shady areas in the warmer regions of the country. Fine fescue is used extensively in seed blends designed for sun and shade situations. This grass germinates rapidly and establishes quickly.

INFORMATION SHEET

3. Propagation method — Seed

4. Seeding rates — Fine fescue 3-4 pounds per 1000 sq. ft.
   Tall fescue 5-7 pounds per 1000 sq. ft.

5. Cutting heights — 2¼" - 3" for tall fescue

6. Frequency of mowing — Determine the frequency of mowing by growth rate of grasses, not by a schedule. Remove no more than ⅓ of the leaf surface per cutting. During high temperature stress periods, add 1" to the mowing heights.

7. Watering — Use deep, infrequent watering. Water to a depth of 6" - 8". Water again whenever fescue shows slight wilting or discoloration in the morning. Fescue typically wilts during the hot afternoon.

8. Fertilization — 1-2 pounds of actual nitrogen should be applied in the spring, 2-3 pounds of nitrogen in the fall. Unless using a slow release fertilizer, apply only 1 pound of nitrogen per 1000 sq. ft. per application.

   (NOTE: Fertilization rates are determined by the growing season and tend to vary from area to area.)

B. Ryegrass

1. Identification — Ryegrasses are medium to coarse texture and light to dark green in color. Leaves are heavily veined on the upper surface and glossy on the underside.

2. Use — Full sun in cooler regions of the U.S. Shade grass in warmer region of the country.

3. Propagation method — Seed

4. Seeding rates — 6-8 pounds per 1000 sq. ft.

5. Cutting height — 1½" - 2½"

6. Cutting frequency — Mow often enough so that no more than ⅓ of the leaf surface is removed per mowing.

7. Watering — Water to a depth of 6" - 8" whenever signs of wilting or turf discoloration occur in the morning.

8. Fertilization — 1-2 pounds actual nitrogen per 1000 sq. ft. in the spring, 3-4 pounds actual nitrogen per 1000 sq. ft. per application if using a water-released fertilizer.

   (NOTE: Fertilization rates are determined by the growing season and tend to vary from area to area.)

INFORMATION SHEET

C. Bluegrass

1. Identification — Kentucky bluegrass is dark green in color with medium-textured blades. It is spread by tillers and rhizomes, and has the ability to form an attractive tight turf.

2. Use — Full sun in cooler regions of the U.S.; requires sun in the warmer regions.

3. Propagation method — Seed

4. Seeding rates — 1-1½ pounds per 1000 sq. ft.

5. Cutting height — 1½" - 2½". No more than ⅓ of the grass blade should be removed per mowing.

6. Watering — Kentucky bluegrass will withstand periods of drought by becoming dormant. Once irrigation begins, it must be continued throughout the period of drought. Water infrequently, and to a depth of 6".

7. Fertilization — 1-2 pounds of nitrogen per 1000 sq. ft. in spring, 3-4 pounds of actual nitrogen per 1000 sq. ft. in fall.

   (NOTE: Fertilization rates are determined by the growing season and tend to vary from area to area.)

8. Thatch removal — In early spring or fall; remove as much thatch as possible.

D. Bentgrass

1. Identification — Bentgrasses are light to dark blue-green in color, fine textured, and spread by an extensive stolon growth. This stolon growth, in combination with stems and roots, intertwine to form a thatch layer.

2. Use — Golf course putting greens

3. Propagation — Seeding is most common, but bentgrass can be sprigged.

4. Seeding rates — ½-1 pound per 1000 sq. ft.

5. Cutting height — ¼"

INFORMATION SHEET

6. Watering — Plugs should be taken from the greens and checked for moisture. Greens may have to be watered lightly several times a day to "cool" the greens.

7. Fertilization — Fertilizer requirements for bentgrass is a very exacting science, and is determined by monthly soil tests. Whenever fertilizer is applied, it must be thoroughly watered immediately to avoid burning of the grass.

   (NOTE: Fertilization rates are determined by the growing season and tend to vary from area to area.)

8. Dethatching - This is usually accomplished by aerifying the greens. This usually enables the thatch layer to naturally decompose.

V. **Warm season grasses** (Transparency 2)

A. Bermuda

1. Identification — Bermudagrass is generally a fine textured grass which is a medium to dark green in color. Because of the extensive growth of stolons and rhizomes, bermuda forms a very dense, thick turf.

2. Use — Full sun

3. Propagation — Sprigs, plugs, or sod. Seed is used occasionally, but will produce only common bermuda. Seeding should not be attempted in areas which have hard freezes.

4. Planting rates — Variety-type bermuda, 5-10 bushels of sprigs per 1000 sq. ft. Solid sod or plugs cut from sod as desired. Seed should be planted at the rate of 2-3 pounds per 1000 sq. ft.

5. Watering — Approximately 1" per week during March, April, May, and June; 2 inches per week if very warm and dry in July, August, and September; 1" per week in October and November; and 1" per month in December, January, and February.

6. Cutting height — ¾" - 1¾", never removing more than ⅓ of the leaf surface.

7. Fertilization — Use a good 3:1:1 ratio-balanced fertilizer containing iron, zinc, and sulfur. Apply 2 pounds actual nitrogen per 1000 sq. ft. every 6 weeks starting when greening stolons are first observed in the spring. Stop fertilizing in the fall. Soil testing is important so that the fertility levels can be brought to recommended levels.

   (NOTE: Fertilization rates are determined by the growing season and tend to vary from area to area.)

INFORMATION SHEET

8. Dethatching — Common, every 5 years; U-3, every two or three years; tiff type grass, on a yearly basis.

   (NOTE: In some regions of the country where bermuda is the most common turf, overseeding the dormant sod with annual ryegrass is practiced. Care must be taken because you can never fully eradicate annual ryegrass, as it will co-exist with bermuda for years, which is considered unsightly by many. Overseeding does give the homeowner a green lawn during the winter months when bermudagrass is dormant.)

B. Zoysia

1. Identification — Zoysia is fine to medium in texture, dark green, and spread by means of rhizomes and stolons.

2. Use — Full sun to partial shade, hot to very cold climates, and is extremely wear-resistant.

3. Propagation — Plugs or solid sodding. Best results can be obtained by using solid sod due to the extremely slow spreading rate of zoysia.

4. Cutting height — ¾" - 1½"

5. Watering - Zoysia is not drought hardy, so soil moisture must be maintained at all times. Overwatering will tend to drowned out the turf.

6. Fertilization — Frequent applications of fertilizer are needed to maintain vigorous growth.

   (NOTE: Fertilization rates are determined by the growing season and tend to vary from area to area.)

C. St. Augustine

1. Identification — St. Augustine is coarse in texture and is spread by above ground stolons. Growth is so vigorous that thatch buildup causes major problems.

2. Use — St. Augustine is very sensitive to freeze damage, and will winter kill if exposed to freezing-thawing weather for a period of two weeks. It is shade tolerant and adaptable to most soils.

3. Propagation — Seed is rarely produced by St. Augustine, so sprigs or sod are the methods used in installing a lawn.

4. Cutting height — 1½" - 3"

INFORMATION SHEET

5. Fertilization — Frequent applications of fertilizer are needed to maintain good color and growth.

6. Dethatching — Diseases such as brown patch and insects such as chinchbugs and sod webworms thrive because of thatch buildup so a good thatch removal program is necessary.

D. Centipedegrass

1. Identification — Centipede grass is medium to coarse in texture and is bluish-green in color. It is spread by stolons which form good, dense, low turf.

2. Use — Well adapted to poor acid soils and will tolerate partial shade; has poor traffic tolerance, poor salt tolerance, is sensitive to many herbicides, and usually goes dormant early in fall and turns brown

3. Propagation — Seed, sod, or stolonizing

4. Seeding rates — ¼ to ½ pound per 1000 sq. ft.

5. Watering — Has poor drought resistance

6. Cutting height — 1" - 2"; should use a rotary-type mower

7. Fertilization — Should not be over fertilized (not more than 2.4 lbs. of actual nitrogen per 1000 sq. ft. per year)

8. Dethatching — Should be dethatched often to prevent turf decline

VI. **Turfgrass adaptation zones** (Transparency 3)

A. Zone 3, 4, 5 — Bluegrass, fine fescue, bentgrass, tall fescue, ryegrass

B. Zone 6 — Bermuda, ryegrass, zoysia, fine fescue, bentgrass, bluegrass, tall fescue

C. Zone 7 — Bermuda, St. Augustine, zoysia, (fescue and rye in shade and cooler seasons)

D. Zone 8 — St. Augustine, bermuda, zoysia, centipedegrass

E. Zone 9, 10 — St. Augustine, bermuda, zoysia, centipedegrass

INFORMATION SHEET

VII. Questions to ask to determine proper turf selection

A. Is the turf variety adapted to this area? (Refer to previous objective.)

B. What kind of lawn is wanted?

Examples: High traffic, low traffic, type of grass that is pleasing to the owner

C. What special physical problems does the lawn have?

Examples: Shade, sun, slope, poor air circulation, poor water drainage

D. How much maintenance is needed?

(NOTE: Knowing how to care for the type of turf is the best way to be pleased with the growth.)

VIII. Common turf insect pests (Transparencies 4-7)

Name of Pest	Description	Damage	Appearance of Turf Damage
A. White grubs (Transparency 5)	•Adult-May, June, or Japanese beetle •Larvae-Creamy, white, c-shaped, brown head, six legs, 1-1½" long	•Adult-Feeds on flowers, leaves, fruit •Larvae-Feeds on root system	•Dead patches of sod which can be rolled up like carpet •Highest concentration of grubworms will be found around perimeter of damaged area •Secondary damage — Encourages lawn damage by raccoons, skunks, and moles as they feed on this pest
B. Billbug grubs	•Adult-Beetle, clay colored, with long snout or bill, up to ¾" long •Larvae-White, ½" - ¾" long, have an orange brown head, dark humped back, with no legs	•Adult-Feeds on grass •Larvae-Chews near the crown and eats the roots slightly below ground level of the turf plant	•Often damage is indefinite pattern but causes general thinning of the turf

INFORMATION SHEET

Name of Pest	Description	Damage	Appearance of Turf Damage
C. Armyworms	•Adult-Dull colored brown moth with 1½" wing spread •Larvae-Segmented bodies between ¾" - 1½" long, an inverted U at its head connecting to a yellowish white stripe that runs down the entire length of its back, 3 stripes that run along the body of each side, 6 legs	•Adult-No damage to turf •Larvae-Starts feeding in bright sunny areas of turf moving in extremely large numbers, eating all vegetation in path. This characteristic gives them their name as moving like armies. These armies of worms can be devastating to turf and landscapes	•Areas are bare of all vegetation
D. Cutworms	•Adult Moths-Pale brownish gray, with a wingspread of 1½" •Larvae-1"-2" long, six legs, greenish gray, brown, or black	•Adult-No damage to turf •Larvae-Feeds at night and hides in debris and thatch during the day	•Chewed leaf blades, skeletonized or completely severed leaf blades
E. Sod webworms (Transparency 6)	•Adult-Small brown moth with ¾" wing spread. Females fly over turf dropping eggs into the grass •Larvae-¾" long, greenish-brown with a segmented body	•Larvae-Chews on leaf blades cutting them in half or severing them at the ground	•Completely stripped patches of turf
F. Chinch bugs (Transparency 7)	•Adult-Black, 6 legs, 2 antennae, with black and white wings •Nymphs-Yellow at birth, turning red with a white band across the body. The nymphs then turn dark brown as they approach adulthood.	•Adults-Start feeding when temperature reaches the 70's and above •Nymphs-Start feeding immediately at birth	•Symptoms first appear as patches of dead grass in areas near driveways, curbs, and sidewalks where heat is radiated from the sun. This insect inserts a small slender beak into plant tissue, injects a toxin, and sucks plant juices. Severe infestation causes death of turf from this toxin.

INFORMATION SHEET

IX. Common turf weed problems (Transparencies 8 and 9)

Weed Name	Description	Lifespan	First Appearance	Flower/Seed
A. Monocot weeds				
1. Crabgrass	Pale green grassy type weed, branches freely	Annual	Late Spring	Finger-like seed heads
2. Annual bluegrass (Poa Annua)	Low growing annual, apple green, grows vigorously in cool moist weather	Annual	Late Winter	Very heavy whitish-green seedheads at any mowing height
3. Johnson grass	Tall growing grass (6'-8'), long narrow strap-like leaves off main rigid stem	Perennial	Spring	Red seed on open stem at top of plant
4. Bermudagrass	Grass which spreads by stolons and rhizones. Turns brown after frost. Leaves are borne on stems with both long and short internodes.	Perennial	Spring	"Crowsfoot" shape emerging above height of turf
B. Dicot weeds				
1. Dandelion	Long, narrow lobed or serrated leaves. These lobes are generally opposite each other and point backward toward the crown of the rosette.	Perennial	Spring	Yellow seedheads, white puffballs
2. Henbit	Square shaped main stem. Leaves are rounded, hairy, coarsely toothed, and deeply veined. Leaves are opposite.	Annual	Late winter with biggest infestation in spring	Trumpet shaped, pale purple flowers
3. Chickweed	Creeping habit with bright shiny green leaves. Leaves are rounded and taper to a point. Leaves are opposite each other on hairy stems. Roots easily at leaf junction. Forms dense spreading pattern over lawn.	Annual	All seasons of year	White flowers with fine deeply notched petals

INFORMATION SHEET

X. Common turf diseases (Transparency 10)

Disease	Symptoms	Susceptible Grasses	Conditions Favorable For Development Of Disease	Cultural Control
A. Brown Patch	Small irregular patches that may enlarge to cover several square feet. Centers of these patches may recover leaving rings of infected areas. Blades turn brown and die.	Bentgrass Bermudagrass Bluegrass Fescue Ryegrass Zoysia St. Augustine	75°-95°F temperatures High soil moisture High humidity Excessive watering Excessive fertilization	Reduce nitrogen Improve drainage Water deeply and infrequently Remove thatch buildup
B. Rust	Reddish pustules or "blisters" of spores appear on stems and leaves. Rust appears on shoes and clothing. Turf looks yellow from a distance and is stunted in growth.	Bermudagrass Bluegrass Fescue Ryegrass	Warm temperature Low soil moisture High humidity Low fertility Inadequate moisture	Increase fertility to help in growing turf out of disease Adequate irrigation
C. Leaf spot	Straw colored spots on leaves and stems with each light spot surrounded by a ring of purple or brown. If crown of plant is affected, the entire plant will die causing a thinning of the turf.	Bentgrass Bermudagrass Bluegrass Fescue Ryegrass Zoysia	50°-70°F temperatures High moisture Compacted soils Mowing height too low	Reduce shade Improve soil aeration Improve water drainage Mow 1¾" and higher
D. Powdery mildew	White dusty powder on the leaves and stems of turf. Gives turf a whitish cast. This disease is not particularly damaging to the turf itself, but does encourage invasion of secondary fungi.	Bentgrass Bermudagrass Bluegrass Fescue Ryegrass Zoysia	Warm temperatures High humidity Poor air movement Shaded turf Wet turf at night	Increase air circulation Provide more sunlight Do not water at night
E. Dollar Spot	Leaves become water soaked, turn brown, then straw colored. Areas infected start out being the size of a silver dollar. As the disease progresses, these spots merge to form large irregular areas. Cobweb-type white fungus threads may be seen in cooler temperatures of the day.	Bentgrass Bermudagrass Bluegrass Fescue Ryegrass Zoysia	60°-80°F temperatures Excessive moisture Excess thatch Inadequate nitrogen Shallow watering	Remove thatch Fertilize with nitrogen Water to a depth of 8"-12"
F. Snow Mold	Infected turf is covered with white or light grey fungus. These turf areas may be as large as 2' in diameter.	Bentgrass Fescue Ryegrass Bluegrass	28°-45°F temperatures Overabundant, excessive snow Excessive thatch Excessive growth of turf before winter weather	Remove thatch at first infestation before turf dies Do not overfertilize in the fall Do not overwater

INFORMATION SHEET

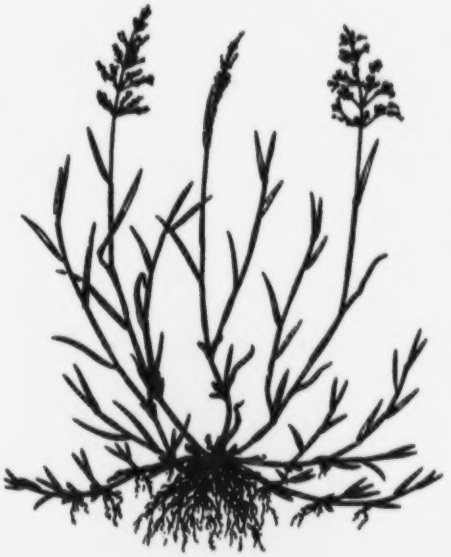
Disease	Symptoms	Susceptible Grasses	Conditions Favorable For Development Of Disease	Cultural Control
G. Pythium	Circular spots 2"-6" in diameter are killed. As the disease intensifies, these spots run together. Leaf blades turn brown, lie flat, stick together, and give a greasy appearance.	Bentgrass Bermudagrass Bluegrass Fescue Ryegrass Zoysia	80°-95°F temperatures Excessive moisture Excessive shade Soil compaction Poor drainage	Provide more sunlight Aerate soil Improve drainage Avoid excessive moisture
H. Fairy Ring	This disease appears as circles or arc in the lawn. The center of the arc appears to be normal with the circumference of the circle dark green with the more rapid growth. The band also is characterized by the presence of mushrooms or "toad stools." These bands are 4"-12" wide with the diameter of the circle ranging from 3'-30' or more. The dark green is because of the excess nitrogen released by the disease, and the band dies because of toxins released by the fungi.	All; disease is soil borne		Remove thatch
I. Spring Dead Spot	Once thought to be winter damage, the fungi Helminthosporium have been isolated in the majority of cases. Dead patches appear in the lawn when bermudagrass turf greens up in the spring. As the season progresses, runners cover these dead spots, but never take root. The following season these same patches reappear but are larger in size. Weeds and other types of turf will grow in these areas.	Bermudagrass	Seems to occur in highly maintained areas	Use an adequate fertility program

Cool Season Grasses

Fescue

Ryegrass

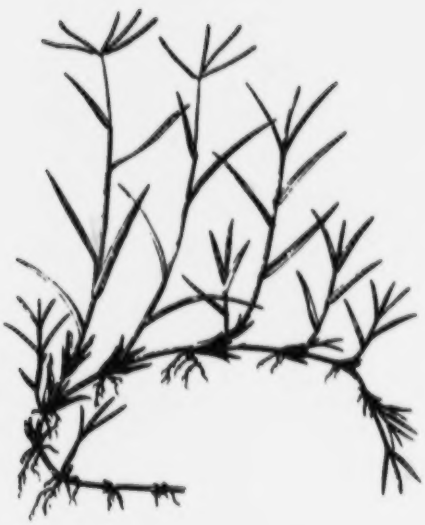
Bluegrass



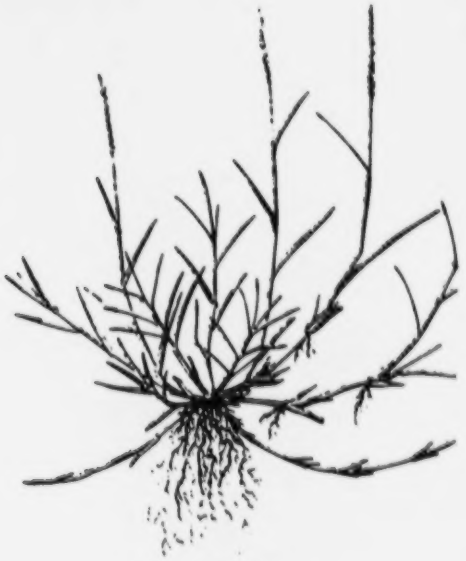
Bentgrass

Courtesy O.M. Scott and Sons
Marysville, Ohio

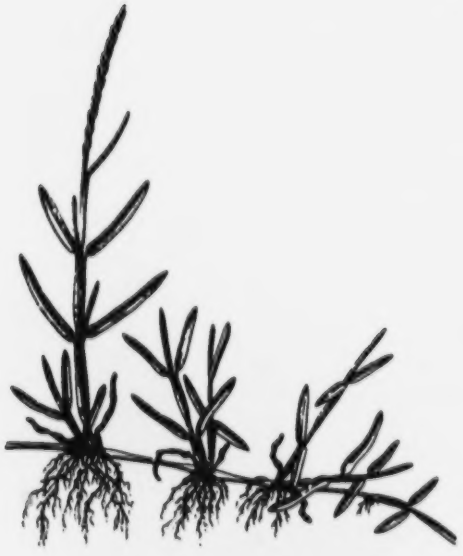
Warm Season Grasses



Bermudagrass



Zoysiagrass



St. Augustinegrass

Centipedegrass

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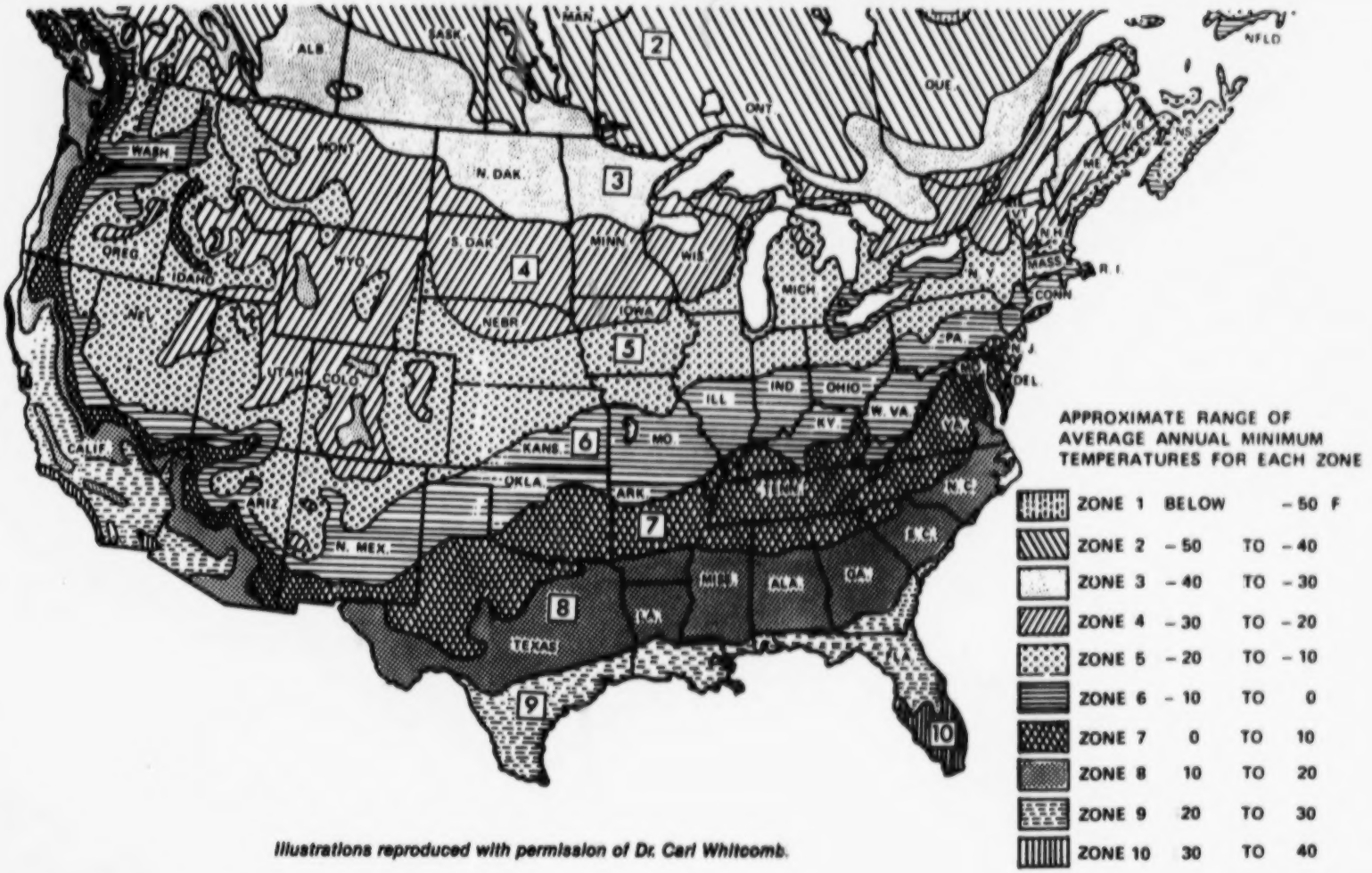
Marysville, Ohio

Turfgrass Adaption Zones



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Common Turf Insect Pests

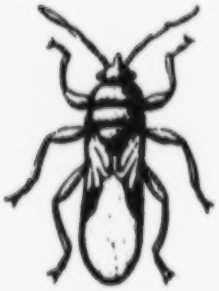
White Grubs

Billbug Grubs

Armyworms

Cutworms

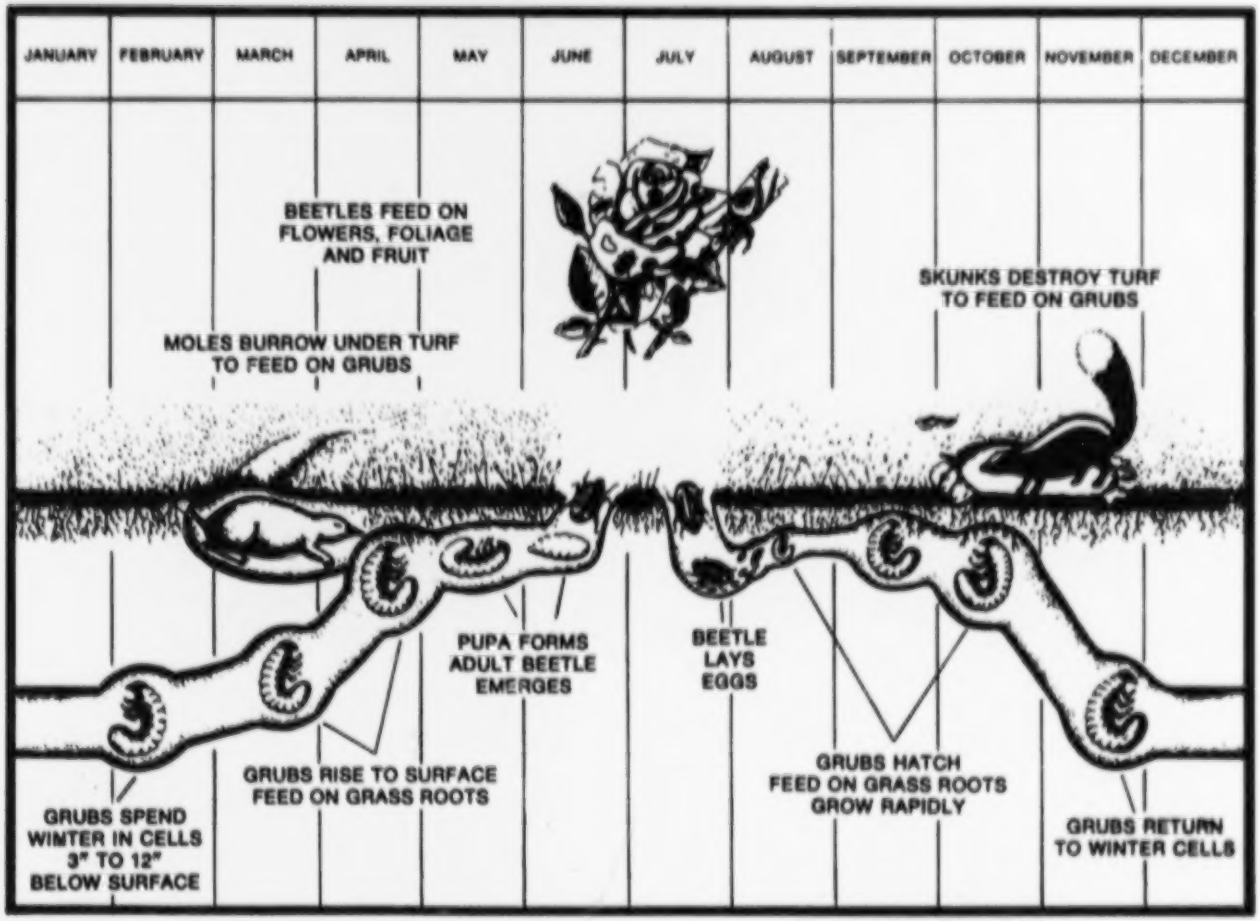
Sod Webworm



Chinch Bugs

Courtesy O.M. Scott and Sons
Marysville, Ohio

Beetle/Grub Life Cycle



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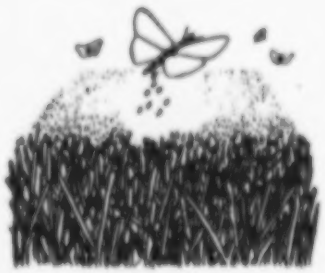
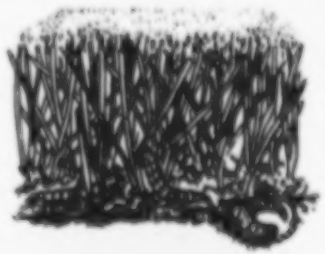
Sod Webworm Life Cycle

LAWN MOTH



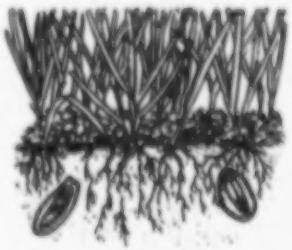
The adult moth is small, dingy brown with a wingspread of about three fourths of an inch. Female moths fly over turf dropping eggs into the grass.

SOD WEBWORM



The sod webworm is three fourths of an inch long, greenish-brown, and has a segmented body. Stiff hairs protrude from dark, circular blotches. Chewed grass blades are a sign that this insect is active.

PUPAE



Sod webworms build loosely woven cocoons just below the soil surface where they change to a brown pupae and later to the adult or moth stage.

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Chinch Bug Life Cycle

Soon after birth, yellow nymphs turn red with a white band across the body. In the second stage the nymph is dark brown.

Nearing the adult stage, nymphs are nearly black and pads form over slowly developing wings. The adult, approximately ⅛" in length, has a black body with black and white wings.

WINTER	SPRING	SUMMER	FALL
Adult chinch bugs hibernate in matted clippings and loose soil near root zone areas. No damage is done to turf during this period.	When temperatures warm to 70°, chinch bugs emerge from hibernation, and extract sap from grass plants. Females deposit 15 to 20 eggs per day for 20 to 30 days.	Eggs hatch in 7 to 10 days. Wingless nymphs start feeding on grass plants immediately. They reach maturity and are capable of reproduction in about 30 days.	Chinch bugs do greatest damage from mid-summer through early fall. With a life cycle of 7 or 8 weeks, two or more generations mature each season. First generations die in the fall. Succeeding generations hibernate at the approach of cold weather.

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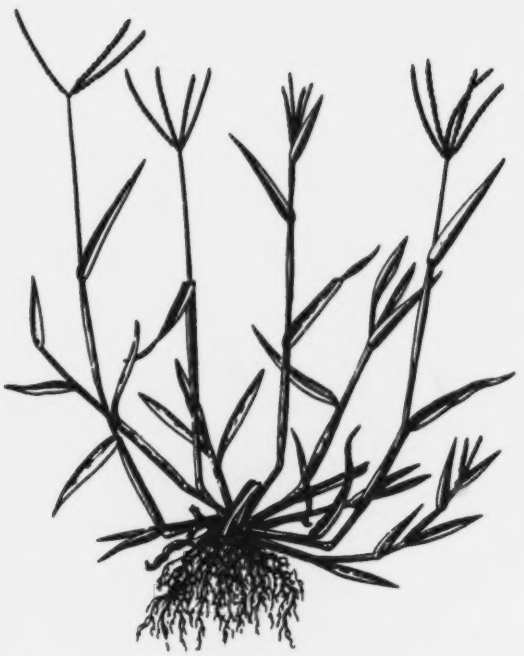
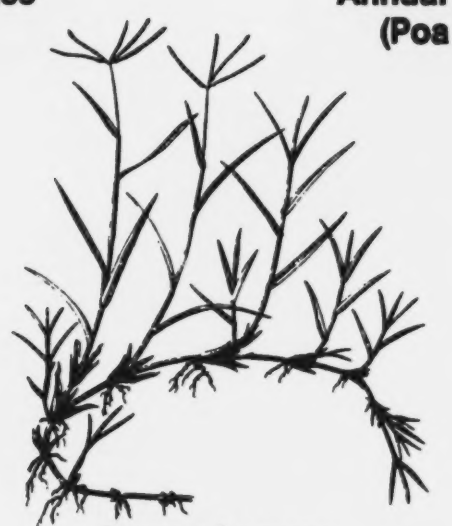
Common Weed Problems

Monocot Weeds



Crabgrass

Annual Bluegrass
(Poa Annua)



Bermudagrass

Courtesy O.M. Scott and Sons
Marysville, Ohio

Common Weed Problems

Dicot Weeds

Dandelion

Henbit

Chickweed

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Common Turf Diseases

Brown Patch

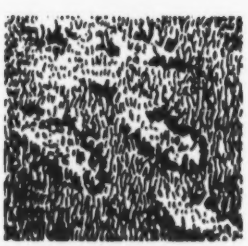
Rust

Leaf Spot

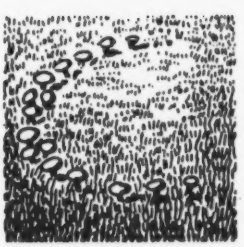
Powdery Mildew

Dollar Spot

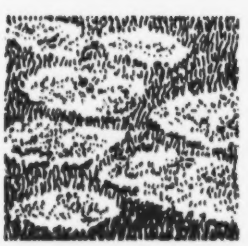
Snow Mold



Pythium



Fairy Ring



Spring Dead Spot

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TURF IDENTIFICATION AND PESTS
UNIT V

ASSIGNMENT SHEET #1 — SELECT APPROPRIATE GRASSES FOR VARIOUS CONDITIONS AND ZONES

NAME _____ SCORE _____

Directions: Given the following situations select an appropriate type of grass for a prospective customer.

1. Very sunny, high traffic area in zone #7_____
2. Shaded, high traffic area in zone #7_____
3. Shaded, low traffic area in zone #7_____
4. Sunny, high traffic area in zone #3_____
5. Sunny, high traffic area in zone #9_____
6. Shaded, high traffic area in zone #9_____
7. Sunny, high traffic area in zone #8_____
8. Shaded, low traffic area in zone #8_____
9. Shaded, high traffic area in zone #6_____
10. Shaded, low traffic area in zone #6_____
11. Sunny, high traffic area in zone #6_____
12. Sunny, high traffic area in zone #5_____
13. Sunny, high traffic area in zone #4_____
14. Shaded, low traffic area in zone #5_____

TURF IDENTIFICATION AND PESTS
UNIT V

ASSIGNMENT SHEET #2 — LOCATE AND DESCRIBE LOCAL TURF INSECTS

NAME _____ SCORE _____

Directions: Choose two of the turf insects listed in the information sheet. Try to find samples of these insects and preserve them for a collection. Also prepare a paper outlining the specific characteristics and essential facts about these insects. Share your collection with the other class members.

TURF IDENTIFICATION AND PESTS
UNIT V

ASSIGNMENT SHEET #3 — LOCATE AND DESCRIBE LOCAL TURF WEEDS

NAME _____ SCORE _____

Directions: Collect samples of four of the turf weeds listed in the information sheet. Prepare an outline of the identifying characteristics, lifespan, structure, and control for each weed.

TURF IDENTIFICATION AND PESTS
UNIT V

ASSIGNMENT SHEET #4 — DESCRIBE SYMPTOMS FOR VARIOUS TURF DISEASES

NAME _____ SCORE _____

Directions: Describe the symptoms of the following diseases and describe conditions under which you would expect to see these diseases develop.

1. Brown patch_____

2. Rust_____

3. Powdery mildew_____

4. Dollar spot_____

5. Spring dead spot_____

TURF IDENTIFICATION AND PESTS
UNIT V

ASSIGNMENT SHEET #5 — ANSWER QUESTIONS USING A CHEMICAL CONTROL CHART PROVIDED BY INSTRUCTOR

NAME _____ SCORE _____

Directions: Answer the following questions using the most recent chemical chart available which should be provided by your instructor.

1. What chemicals can be used for control of fleas?_____
2. What insects can diazinon be used on?_____
3. When is the bermudagrass mite most active?_____
4. What should be done after treating for armyworms and cutworms?_____

   _____
5. What chemicals should be used to control clover?_____
6. When should the chemical application for winter annual grasses be applied?_____

   _____
7. What chemical should be used for nutgrass?_____
8. When should chemical be used to control chickweed and henbit?_____

   _____
9. How should you determine if you have a nematode problem in bentgrass?_____

   _____
10. What is the control for nematodes?_____
11. When should crabgrass be controlled in bentgrass?_____

    _____
12. What chemicals should be used to control sandburs?_____

TURF IDENTIFICATION AND PESTS
UNIT V

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1. Bermuda, zoysia
2. Fescue, zoysia
3. Ryegrass
4. Bluegrass, fescue, bentgrass, ryegrass
5. St. Augustine, bermuda, zoysia
6. Zoysia, St. Augustine
7. Bermuda, zoysia, St. Augustine
8. St. Augustine, zoysia
9. Zoysia, fescue, bluegrass
10. Rye, bluegrass
11. Fescue, bluegrass, zoysia
12. Fescue, bluegrass, zoysia
13. Bluegrass, fescue
14. Bluegrass, fescue, ryegrass

Assignment Sheet #2 - #5 — Evaluated to the satisfaction of the instructor

TURF IDENTIFICATION AND PESTS
UNIT V

JOB SHEET #1 — SEED A LAWN USING A HYDROMULCHER

A. Tools and materials

1. Hoe
2. Rototiller
3. Fertilizer (optional)
4. Garden rake
5. Seed for the lawn
6. Water hose
7. Source of water
8. Hydromulcher
9. Hydromulcher fiber

B. Procedure

1. Ask instructor to assist in getting tools and materials to desired area.
2. Clear ground of all tall weeds and debris.
3. Fertilize soil if directed by instructor.
4. Till area 1"-2" deep.
5. Rake soil out level.
6. Use hydromulcher to seed at correct rate.
   a. Fill hydromulcher ⅔ full of water.
   b. Start engine.
   c. Add fiber material according to label directions.
   d. Add seed.
   e. Add fertilizer if not previously applied to the ground.

JOB SHEET #1

f. Finish filling tank with water.

g. Continue mixing until mixed well.

h. Spray mixture onto prepared soil area according to directions on fiber material.

i. Make sure coverage is uniform and thorough.

7. Water lightly so as not to wash away seed.

8. Pump all water through the hydromulcher, and thoroughly clean the machine.

9. Answer the following questions about the care of the seeded area.

a. How often should this area be watered?_____

b. At what height should this area be mowed and when?_____

_____

c. When should this area be fertilized and how much?_____

_____

TURF IDENTIFICATION AND PESTS
UNIT V

JOB SHEET #2 — OVERSEED A LAWN USING A SEEDER

A. Tools and materials

1. Garden rake
2. Fertilizer
3. Seed
4. Lawnmower
5. Seeder
6. Water hose
7. Source of water

B. Procedure

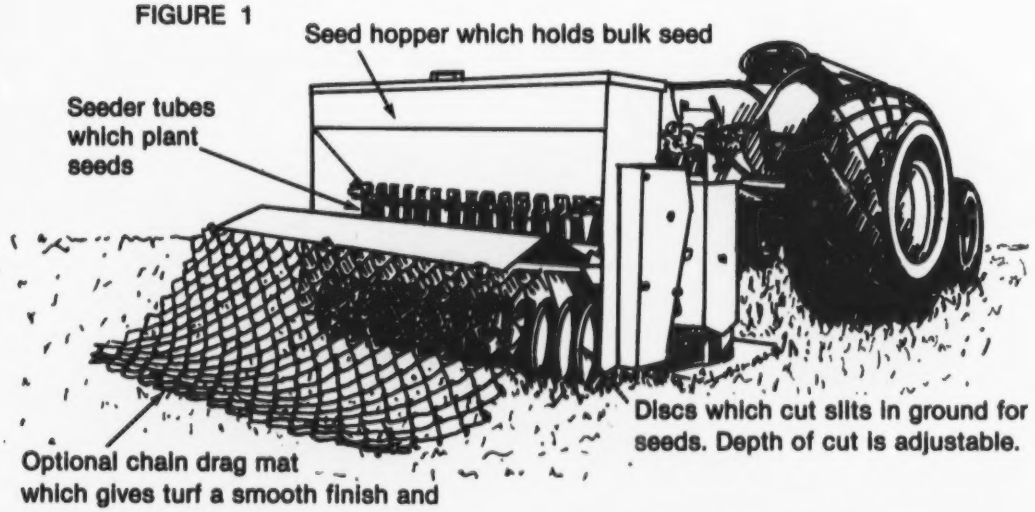
1. Ask instructor to assist in getting tools and materials to desired area.
2. Use lawnmower to mow existing grass short (1").
3. Calibrate the seeder for the recommended rate of seed used.

   (NOTE: Some seeders can apply fertilizer at the same time as the seed. If your equipment has that capacity, it will need to also be calibrated for the recommended fertilizer rate.)

4. Load seeder with seed (and fertilizer) *off* the site.

JOB SHEET #2

FIGURE 1


Seed hopper which holds bulk seed
Seeder tubes which plant seeds
Discs which cut slits in ground for seeds. Depth of cut is adjustable.
Optional chain drag mat which gives turf a smooth finish and covers seed with soil after seeding.

Model shown is tractor pulled. (Jacobsen 548-100). Self-propelled models are also available.

5. Operate seeder according to manufacturer's instructions making sure you have the proper overlap.

6. Empty seeder of excess seed (and fertilizer) and follow proper cleaning and storage procedures as described in Job Sheet #4.

7. Water lightly so as not to wash away seed.

8. Answer the following questions about the care of the overseeded area.

   a. At what height should the mowing be maintained?_____

   _____

   b. How often should the grass and seeds be watered?_____

   _____

   c. When should new lawn be fertilized again?_____

   d. Is it possible to seed a cool season grass over a dormant warm season grass? Why would you want to do this?_____

   _____

TURF IDENTIFICATION AND PESTS
UNIT V

JOB SHEET #3 — SPRIG A LAWN USING A TRACTOR TILLER

A. Tools and materials

1. Garden rake
2. Tractor tiller
3. Sprigs or plugs
4. Fertilizer
5. Shovel or hand trowel (if plugging)
6. Water hose
7. Source of water

B. Procedure

1. Apply fertilizer to top of soil.
2. Use tractor tiller to till to a depth of 3"-4".
3. Sprig or plug lawn as directed by instructor.
   a. To sprig — Apply sprigs by scattering them on the ground and tilling them in lightly until most are incorporated into soil.
   b. To plug — Hand dig holes for plugs based on 12" centers.
4. Water thoroughly (4"-6" deep) to keep ground underneath surface moist.
5. Answer the following questions about the care of this newly installed lawn.
   a. When should it be fertilized and at what rate?_____
   _____
   b. Should sprigs be watered more often than seed? Why or why not?_____
   _____
   _____

TURF IDENTIFICATION AND PESTS
UNIT V

JOB SHEET #4 — USE A DROP-TYPE FERTILIZER SPREADER

A. Tools and materials

1. Drop-type fertilizer spreader
2. Fertilizer
3. Scale that measures in ounces
4. Broom and dust pan
5. Sheet of plastic
6. Light oil

B. Procedure

(NOTE: The person who calibrates the spreader must spread it.)

1. Locate a smooth flat area 5 x 12 or use a sheet of plastic.
2. Sweep this area clean.
3. Mark an area 10' long.
4. Fill the spreader with fertilizer.
5. Set the fertilizer spreader at the middle setting.
6. Walk at normal speed across the 10-foot strip, turning on the spreader at the first mark and shutting it off at the second.
7. Sweep the fertilizer that was dropped and weigh what was spread. Record in ounces.

   (NOTE: Some spreaders are equipped with a catcher which can be emptied and weighed when calibrating.)
8. Determine how much fertilizer should have been dropped by:

   a. Determine the amount of material (A) to be spread per 1000 sq. ft., in ounces.

   b. Determine the total area (B) to be covered by the spreader in the 10' test strip [10 feet x 3 feet (width of spreader)] = 30 square feet.

JOB SHEET #4

c. Set up the proportion (C) equaling the amount of material that should fall from the spreader.

$$\frac{\text{(A) ounces}}{\text{1000 sq. ft.}} = \frac{\text{(C) ounces}}{\text{(B) sq. ft.}}$$

$$\text{where (C)} = \frac{\text{(A)} \times \text{(B)}}{\text{1000 sq. ft.}}$$

d. The answer calculated in step 8c should equal the weight of fertilizer dropped on the sample strip. If the recorded weight is less than the calculated value, repeat this procedure with the spreader set to a large opening. If the weighed value is more, the spreader opening should be smaller.

Example: A 50-pound bag of 33-0-0 (Ammonium Nitrate) is to be applied to a lawn at a rate of 1 pound of nitrogen per 1000 sq. ft. You would need to apply 3 pounds of material per 1000 sq. ft. since the material is 33% nitrogen. A 36 inch spreader is to be used. 3 pounds equals 48 ounces.

1) (A) = 48 ounces of 33-0-0 per 1000 sq. ft.
2) (B) = 10' (length) × 3' (width) = 30 sq. ft.
3) $\frac{\text{48 ounces}}{\text{1000 sq. ft.}} = \frac{\text{(C) ounces}}{\text{30 sq. ft.}}$

$$\text{where (C)} = \frac{\text{48 ounces} \times \text{30 sq. ft.}}{\text{1000 sq. ft}}$$

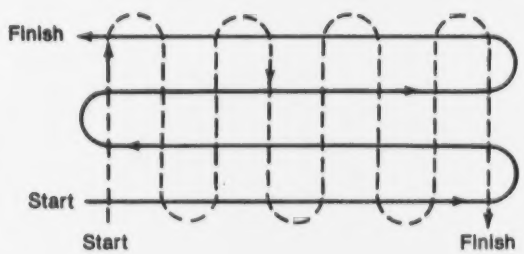
(C) = 1.44 ounces

The spreader should have dropped close to 1½ ounces of fertilizer on the test strip. If not, readjust the setting and try again. Understand that one number on the setting is not related to another number. In other words a setting of "4" on the spreader does **not** apply 4 times the amount of fertilizer as the setting of "1".

(NOTE: Record all the information about the calibration results so you do not have to recalibrate next time you use the **same** spreader and the **same** fertilizer.)

9. It is always best if you calculate on the basis of applying ½ the amount per application. Then change directions and apply the other ½ of the fertilizer. This helps in avoiding skips and overlaps.

FIGURE 1



JOB SHEET #4

10. After using the fertilizer spreader, remove all excess material from the spreader. Never store unused material in the hopper.

11. Thoroughly wash the inside of the hopper as well as external surfaces.

12. Dry the spreader. This will minimize rust formation which will severely affect the uniformity of fertilizer application.

13. Apply a thin layer of oil to exposed metal surfaces. Do not forget to oil the wheels.

14. Check for worn or broken parts. Replace those parts prior to next use.

15. Store spreader with opening in wide open position.

TURF IDENTIFICATION AND PESTS
UNIT V

JOB SHEET #5 — USE A BROADCAST OR ROTARY-TYPE FERTILIZER SPREADER

A. Tools and materials

1. Broadcast or rotary-type spreader
2. Fertilizer
3. Scale that measures in ounces
4. Broom and dust pan
5. Sheet of plastic
6. Light oil

B. Procedure

(NOTE: The person who calibrates the spreader must spread it.)

1. Partially fill the spreader with fertilizer and mark the level on the side of the hopper.
2. With the spreader set at a middle setting, operate it over an area of known dimensions. For example, if the spreader has a 6 foot spreading swath and is operated for 50 feet, it will have covered 300 sq. ft. (6 × 50 = 300).

   (NOTE: Some spreaders are equipped with catchers which can be emptied and weighed when calibrating.)
3. Place a piece of cloth on the inside of the hopper and pour in fertilizer until it has reached the marked level.
4. Remove and weigh the amount of fertilizer that was added to refill the hopper to the marked level.
5. Record this weight in ounces.

   (NOTE: Uniform distribution is a problem, but can be controlled by overlapping. To uniformly spread a fertilizer, apply half of the material in one direction, and the other half at right angles to the first. This means that when the rotary spreader is calibrated, it will be for half the recommended rate.)

JOB SHEET #5

6. Determine how much fertilizer should have been applied.

   a. Determine the amount of material (A) to be spread per 1000 sq. ft

   b. Determine the total area (B) to be covered with fertilizer i.e. 50 feet (length of test area) × 6 feet (width of spreader swath) = 300 sq. ft.

   c. Set up the proportion with (C) ÷ 2 equals the amount of materials that should fall from the spreader.

   $$\frac{\text{(A) ounces}}{\text{1000 sq. ft.}} = \frac{\text{(C) ounces}}{\text{(B) sq.ft.}}$$

   where $(C) = \frac{(A) \times (B)}{\text{1000 sq. ft.}}$

   and (C) ÷ 2 = amount of fertilizer that should be added to hopper

   d. The final answer should equal the weighed fertilizer. If the weighed value is less than the calculated value, set the spreader with a larger opening and repeat the procedure. If the weighed value is more than the calculated value, the spreader opening should be smaller.

   (NOTE: Record all the information about the calibration results so you do not have to recalibrate next time you use the **same** spreader and the **same** fertilizer.)

7. Spread the fertilizer uniformly by applying **half** of the material in one direction, and the other **half** at right angles to the first. This means that when the rotary spreader is calibrated, it will be for **half** the recommended rate.

8. After using the fertilizer spreader, remove all excess material from the spreader. Never store unused material in the hopper.

9. Thoroughly wash the inside of the hopper as well as external surfaces.

10. Dry the spreader. This will minimize rust formation which will severely affect the uniformity of fertilizer application.

11. Apply a thin layer of oil to exposed metal surfaces. Do not forget to oil the wheels.

12. Check for worn or broken parts. Replace those parts prior to next use.

13. Store spreader with opening in wide open position.

TURF IDENTIFICATION AND PESTS
UNIT V

PRACTICAL TEST
JOB SHEET #1 — SEED A LAWN USING A HYDROMULCHER

STUDENT'S NAME _____ DATE _____

EVALUATOR'S NAME _____ ATTEMPT NO. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

(EVALUATOR NOTE: Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.)

The student:	YES	NO
1. Checked out proper tools and materials.	_____	_____
2. Cleared ground of debris and tall weeds.	_____	_____
3. Fertilized soil.	_____	_____
4. Tilled area 1"-2" deep.	_____	_____
5. Raked soil out smooth.	_____	_____
6. Used hydromulcher to apply seed.	_____	_____
7. Watered lightly.	_____	_____
8. Emptied and cleaned hydromulcher.	_____	_____
9. Answered questions correctly.	_____	_____
a. 2-3 times per day for 2 weeks; after that once a day but lightly so as not to wash away seed.	_____	_____
b. It should be mowed as soon as there is enough growth to mow and the ground is dry enough to avoid leaving wheel ruts from the mower. It should be mowed at a height of 2-2½".	_____	_____
c. Fertilize one month after seeding at half the normal rate for that particular type of grass.	_____	_____
10. Followed all safety rules.	_____	_____
11. Checked in/put away tools and materials.	_____	_____

EVALUATOR'S COMMENTS: _____

_____

JOB SHEET #1 PRACTICAL TEST

PRODUCT EVALUATION

(EVALUATOR NOTE: Rate the student on the following criteria by circling the appropriate numbers. Each item must be rated at least a "3" for mastery to be demonstrated. (See performance evaluation key below.) If the student is unable to demonstrate mastery, student materials should be reviewed and another product must be submitted for evaluation.)

Criteria:

	4	3	2	1
Correct amounts of seed and fertilizer used				
	4	3	2	1
Seed and fertilizer correctly spread out				
	4	3	2	1
Adequate water applied				

EVALUATOR'S COMMENTS: _____

_____

PERFORMANCE EVALUATION KEY
4 — Skilled — Can perform job with no additional training. 3 — Moderately skilled — Has performed job during training program; limited additional training may be required. 2 — Limited skill — Has performed job during training program; additional training is required to develop skill. 1 — Unskilled — Is familiar with process, but is unable to perform job.

(EVALUATOR NOTE: If an average score is needed to coincide with a competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria.)

TURF IDENTIFICATION AND PESTS
UNIT V

PRACTICAL TEST
JOB SHEET #2 — OVERSEED A LAWN USING A SEEDER

STUDENT'S NAME _____ DATE _____

EVALUATOR'S NAME _____ ATTEMPT NO. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

(EVALUATOR NOTE: Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.)

The student:	YES	NO
1. Checked out proper tools and materials.	_____	_____
2. Mowed to desired height (1").	_____	_____
3. Calibrated the seeder.	_____	_____
4. Loaded seeder.	_____	_____
5. Operated seeder.	_____	_____
6. Emptied and cleaned seeder.	_____	_____
7. Watered lightly without washing away seeds.	_____	_____
8. Answered questions about care of newly overseeded lawn.	_____	_____
a. 1" for 3-4 mowings, then regular height for that particular type of grass.	_____	_____
b. 1-2 times per day for first two weeks, then less often and a heavier amount each time to help root development.	_____	_____
c. One month after seeding.	_____	_____
d. Yes, for an evergreen effect of lawn.	_____	_____
9. Followed all safety rules.	_____	_____
10. Checked in/put away tools and materials.	_____	_____

EVALUATOR'S COMMENTS: _____

_____

JOB SHEET #2 PRACTICAL TEST

PRODUCT EVALUATION

(EVALUATOR NOTE: Rate the student on the following criteria by circling the appropriate numbers. Each item must be rated at least a "3" for mastery to be demonstrated. (See performance evaluation key below.) If the student is unable to demonstrate mastery, student materials should be reviewed and another product must be submitted for evaluation.)

Criteria:

4 3 2 1

Lawn cut to correct depth

4 3 2 1

Appearance is neat

4 3 2 1

Correct amounts of seed and fertilizer used

4 3 2 1

Adequate water applied

EVALUATOR'S COMMENTS: _____

_____

PERFORMANCE EVALUATION KEY
4 — Skilled — Can perform job with no additional training. 3 — Moderately skilled — Has performed job during training program; limited additional training may be required. 2 — Limited skill — Has performed job during training program; additional training is required to develop skill. 1 — Unskilled — Is familiar with process, but is unable to perform job.

(EVALUATOR NOTE: If an average score is needed to coincide with a competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria.)

TURF IDENTIFICATION AND PESTS
UNIT V

PRACTICAL TEST
JOB SHEET #3 — SPRIG A LAWN USING A TRACTOR TILLER

STUDENT'S NAME _____ DATE _____

EVALUATOR'S NAME _____ ATTEMPT NO. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

(EVALUATOR NOTE: Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.)

The student:	YES	NO
1. Checked out proper tools and materials.	_____	_____
2. Applied fertilizer to soil.	_____	_____
3. Tilled to a depth of 3"-4".	_____	_____
4. Incorporated sprigs into the top 3"-4" of soil (for sprigging).	_____	_____
5. Seated plugs in hand dug holes (for plugging).	_____	_____
6. Watered thoroughly to keep ground under surface moist.	_____	_____
7. Answered questions correctly.	_____	_____
a. One month.	_____	_____
b. No, sprigs should be watered less often and more thoroughly because you are promoting more growth underneath the ground (roots) and then leaf growth.	_____	_____
8. Followed all safety rules.	_____	_____
9. Checked in/put away tools and materials.	_____	_____

EVALUATOR'S COMMENTS: _____

_____

JOB SHEET #3 PRACTICAL TEST

PRODUCT EVALUATION

(EVALUATOR NOTE: Rate the student on the following criteria by circling the appropriate numbers. Each item must be rated at least a "3" for mastery to be demonstrated. (See performance evaluation key below.) If the student is unable to demonstrate mastery, student materials should be reviewed and another product must be submitted for evaluation.)

Criteria:				
	4	3	2	1
Correct amount of fertilizer used				
	4	3	2	1
Tilled to correct depth				
	4	3	2	1
Plugs or sprigs made good contact with soil				
	4	3	2	1
Adequate water applied				
	4	3	2	1
Ground surface is smooth				

EVALUATOR'S COMMENTS: _____

_____

PERFORMANCE EVALUATION KEY
4 — Skilled — Can perform job with no additional training. 3 — Moderately skilled — Has performed job during training program; limited additional training may be required. 2 — Limited skill — Has performed job during training program; additional training is required to develop skill. 1 — Unskilled — Is familiar with process, but is unable to perform job.

(EVALUATOR NOTE: If an average score is needed to coincide with a competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria.)

TURF IDENTIFICATION AND PESTS
UNIT V

PRACTICAL TEST
JOB SHEET #4 — USE A DROP-TYPE FERTILIZER SPREADER

STUDENT'S NAME _____ DATE _____

EVALUATOR'S NAME _____ ATTEMPT NO. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

(EVALUATOR NOTE: Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.)

The student:	YES	NO
1. Checked out proper tools and materials.	_____	_____
2. Calculated the correct rate of fertilizer.	_____	_____
3. Calibrated the spreader.	_____	_____
4. Applied ½ fertilizer in one direction.	_____	_____
5. Applied other ½ fertilizer in other direction.	_____	_____
6. Cleaned spreader.	_____	_____
7. Checked in/put away tools and materials.	_____	_____

EVALUATOR'S COMMENTS: _____

_____

JOB SHEET #4 PRACTICAL TEST

PRODUCT EVALUATION

(EVALUATOR NOTE: Rate the student on the following criteria by circling the appropriate numbers. Each item must be rated at least a "3" for mastery to be demonstrated. (See performance evaluation key below.) If the student is unable to demonstrate mastery, student materials should be reviewed and another product must be submitted for evaluation.)

Criteria:

Fertilizer applied at correct rate	4	3	2	1
Pattern of fertilization followed correctly	4	3	2	1
Area is neat	4	3	2	1
Spreader stored in good condition	4	3	2	1

EVALUATOR'S COMMENTS: _____

_____

PERFORMANCE EVALUATION KEY
4 — Skilled — Can perform job with no additional training. 3 — Moderately skilled — Has performed job during training program; limited additional training may be required. 2 — Limited skill — Has performed job during training program; additional training is required to develop skill. 1 — Unskilled — Is familiar with process, but is unable to perform job.

(EVALUATOR NOTE: If an average score is needed to coincide with a competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria.)

TURF IDENTIFICATION AND PESTS
UNIT V

PRACTICAL TEST
JOB SHEET #5 — USE A BROADCAST OR ROTARY-TYPE FERTILIZER SPREADER

STUDENT'S NAME _____ DATE _____

EVALUATOR'S NAME _____ ATTEMPT NO. _____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

PROCESS EVALUATION

(EVALUATOR NOTE: Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.)

The student:	YES	NO
1. Checked out proper tools and materials.	_____	_____
2. Calculated the correct rate of fertilizer.	_____	_____
3. Calibrated the spreader.	_____	_____
4. Applied ½ fertilizer in one direction.	_____	_____
5. Applied other ½ fertilizer in other direction.	_____	_____
6. Cleaned spreader.	_____	_____
7. Checked in/put away tools and materials.	_____	_____

EVALUATOR'S COMMENTS: _____

_____

JOB SHEET #5 PRACTICAL TEST

PRODUCT EVALUATION

(EVALUATOR NOTE: Rate the student on the following criteria by circling the appropriate numbers. Each item must be rated at least a "3" for mastery to be demonstrated. (See performance evaluation key below.) If the student is unable to demonstrate mastery, student materials should be reviewed and another product must be submitted for evaluation.)

Criteria:				
	4	3	2	1
Fertilizer applied at correct rate				
	4	3	2	1
Pattern of fertilization followed correctly				
	4	3	2	1
Area is neat				
	4	3	2	1
Spreader stored in good condition				

EVALUATOR'S COMMENTS: _____

_____

PERFORMANCE EVALUATION KEY
4 — Skilled — Can perform job with no additional training. 3 — Moderately skilled — Has performed job during training program; limited additional training may be required. 2 — Limited skill — Has performed job during training program; additional training is required to develop skill. 1 — Unskilled — Is familiar with process, but is unable to perform job.

(EVALUATOR NOTE: If an average score is needed to coincide with a competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria.)

TURF IDENTIFICATION AND PESTS
UNIT V

TEST

NAME _____ SCORE _____

1. Match the terms on the right with the correct definitions.

_____a.	A tight layer of dead and living stems, leaves, and roots that forms between the soil surface and green vegetation	1. Dicots
_____b.	Whether or not a plant will grow in a particular geographical region	2. Drought
_____c.	Stress caused by naturally-occurring factors such as drought, sunlight, or too much rainfall	3. Environmental stress
_____d.	Damage caused by freezing temperatures, or a combination of cold and lack of moisture	4. Fungicide
_____e.	Damaging climatic conditions brought about by heat and lack of rainfall	5. Herbicide
_____f.	Plants that germinate from the seed with two seedling leaves	6. Insecticide
_____g.	A herbicide which kills after contacting leaves of the plant	7. Local adaptation
_____h.	Plants that germinate from the seed with a single seedling leaf	8. Monocots
_____i.	A material used in controlling weeds	9. Nonselective herbicide
_____j.	A herbicide which kills weeds as they germinate from the seed	10. Postemergence herbicide
_____k.	Anything which damages turf	11. Preemergence herbicide
_____l.	Insects that do damage to plants by chewing the roots	12. Selective herbicide
_____m.	A material used to control insects on desirable plants	13. Surface feeding insects
_____n.	A herbicide which kills every species of plant which it contacts	14. Thatch
		15. Turf pest
		16. Underground feeding insects
		17. Winter kill

TEST

2. Complete statements concerning soil pH by circling the correct answers.

   a. pH is an abbreviation for potential (**halogen, hydrogen**).

   b. On the pH scale (**6, 7**) is neutral.

   c. A pH of (**4.0-4.5, 6.0-6.5**) is desirable for most turfgrasses.

   d. Sulfur can be used to (**raise, lower**) the soil pH.

   e. Gypsum is often used as a soil conditioner on (**sandy, clay**) soils.

3. Distinguish between the major and minor turfgrass nutrients by placing an "X" next to the **major** nutrients.

   _____a. Iron

   _____b. Calcium

   _____c. Potassium

   _____d. Phosphorus

   _____e. Manganese

   _____f. Nitrogen

   _____g. Zinc

   _____h. Copper

TEST

4. Complete the following chart on cool season grasses.

Grass	Description	Use	Propagation Method	Seeding Rate	Cutting Heights
a. _____	Medium green Coarse or fine blade Spread by tillers of short creeping rhizomes	Low maintenance lawns Shady areas in warmer areas	b. _____	Fine - 3-4#/1000 sq. ft. Tall - 5-7#/1000 sq. ft.	c. _____ for tall
d. _____	Light to dark green Heavily veined upper surface and glossy on the underside	Full sun in cooler areas Shade in warmer areas	e. _____	f. ____ # per 1000 sq. ft.	g. _____
h. _____	Dark green Medium texture Forms tight turf	Full sun in cooler areas Shade in warmer areas	i. _____	1 - 1½#/1000 sq. ft.	1½"-2½" Remove less than ⅓ leaf
Bentgrass	Blue-green Fine texture	j. _____	k. _____ l. _____	½ - 1#/1000 sq. ft.	m. _____

5. Complete the following chart on warm season grasses.

Grass	Use	Propagation Method	Cutting Height
Bermuda	a. _____	b. _____ c. _____ d. _____ e. _____	¾"-1¾"
Zoysia	f. _____	g. _____ h. _____	i. _____
j. _____	In areas where it does not freeze, shade	k. _____ l. _____	m. _____
Centipedegrass	Poor acid soils, partial shade, low traffic	n. _____ o. _____ or stolonizing	p. _____

TEST

6. What zone do you live in and what types of grass grow there?_____

_____

7. Name three of the questions that should be asked when trying to determine proper turf selection?

   a. _____

   b. _____

   c. _____

8. Complete chart on common turf insect pests.

Name of Pest	Description	Damage	Appearance of Turf Damage
a. _____	•Adult-May, June, or Japanese beetle •Larvae-Creamy, white, c-shaped, brown head, six legs, 1-1½" long	•Adult-Feeds on flowers, leaves, fruit •Larvae-Feeds on root system	•Dead patches of sod which can be rolled up like carpet •Highest concentration of will be found around perimeter of damaged area •Secondary damage — Encourages lawn damage by raccoons, skunks, and moles as they feed on this pest
b. _____	•Adult-Beetle, clay colored, with long snout or bill, up to ¾" long •Larvae-White, ½" - ¾" long, have an orange brown head, dark humped back, with no legs	•Adult-Feeds on grass •Larvae-Chews near the crown and eats the roots slightly below ground level of the turf plant	•Often damage is indefinite pattern but causes general thinning of the turf
c. _____	•Adult-Dull colored brown moth with 1½" wing spread •Larvae-Segmented bodies between ¾" - 1½" long, an inverted U at its head connecting to a yellowish white stripe that runs length of its back, 6 legs	•Adult-No damage to turf •Larvae-Starts feeding in bright sunny areas of turf moving in extremely large numbers, eating all vegetation in path.	•Areas are bare of all vegetation
d. _____	•Adult Moths-Pale brownish gray, with a wingspread of 1½" •Larvae-1"-2" long, six legs, greenish gray, brown, of black	•Adult-No damage to turf •Larvae-Feeds at night and hides in debris and thatch during the day	•Chewed leaf blades, skeletonized or completely severed leaf blades

TEST

Name of Pest	Description	Damage	Appearance of Turf Damage
e. _____	•Adult-Small brown moth with 3/4" wing spread. Females fly over turf dropping eggs into the grass •Larvae-3/4" long, greenish-brown with a segmented body	•Larvae-Chews on leaf blades cutting them in half or severing them at the ground	•Completely stripped patches of turf
f. _____	•Adult-Black, 6 legs, 2 antennae, with black and white wings •Nymphs-Yellow at birth, turning red with a white band across the body. The nymphs then turn dark brown as they approach adulthood.	•Adults-Start feeding when temperature reaches the 70's and above •Nymphs-Start feeding immediately at birth	•Symptoms first appear as patches of dead grass in areas near driveways, curbs, and sidewalks where heat is radiated from the sun. This insect inserts a small slender beak into plant tissue, injects a toxin, and sucks plant juices. Severe infestation causes death of turf from this toxin.

9. Complete chart on common turf weed problems.

Weed Name	Description	Lifespan	First Appearance	Flower/Seed
a. Monocot weeds				
1) _____	Pale green grassy type weed, branches freely	Annual	Late Spring	Finger-like seed heads
2) _____	Low growing annual, apple green, grows vigorously in cool moist weather	Annual	Late Winter	Very heavy whitish-green seedheads at any mowing height
3) _____	Tall growing grass (6'-8'), long narrow strap-like leaves off main rigid stem	Perennial	Spring	Red seed on open stem at top of plant
4) _____	Grass which spreads by stolons and rhizones. Turns brown after frost.	Perennial	Spring	"Crowsfoot" shape emerging above height of turf

TEST

Weed Name	Description	Lifespan	First Appearance	Flower/Seed
b. Dicot weeds				
1) _____	Long, narrow lobed or serrated leaves generally opposite each other and point backward toward the crown.	Perennial	Spring	Yellow seedheads, white puffballs
2) _____	Square shaped main stem. Leaves are opposite, rounded, hairy, coarsely toothed, and deeply veined.	Annual	Late winter with biggest infestation in spring	Trumpet shaped, pale purple flowers
3) _____	Creeping habit with bright shiny green leaves. Leaves are rounded and taper to a point. Leaves are opposite each other on hairy stems. Roots easily at leaf junction. Forms dense spreading pattern over lawn.	Annual	All seasons of year	White flowers with fine deeply notched petals

10. Complete the following chart on common turf diseases.

Disease	Symptoms	Conditions Favorable For Development Of Disease
a. _____	Small irregular patches that may enlarge to cover several square feet. Centers of these patches may recover leaving rings of infected areas. Blades turn brown and die.	75°-95°F temperatures High soil moisture High humidity Excessive watering Excessive fertilization
b. _____	Reddish pustules or "blisters" of spores appear on stems and leaves. Residue appears on shoes and clothing. Turf looks yellow from a distance and is stunted in growth.	Warm temperature Low soil moisture High humidity Low fertility Inadequate moisture
c. _____	Straw colored spots on leaves and stems with each light spot surrounded by a ring of purple or brown.	50°-70°F temperatures High moisture Compacted soils Mowing height too low

TEST

Disease	Symptoms	Conditions Favorable For Development Of Disease
d. _____	White dusty powder on the leaves and stems of turf. Gives turf a whitish cast. Encourages invasion of secondary fungi.	Warm temperatures High humidity Poor air movement Shaded turf Wet turf at night
e. _____	Leaves become water soaked, turn brown, then straw colored. Areas infected start out being the size of a silver dollar. As the disease progresses, these spots merge to form large irregular areas. Cob-web-type white fungus threads may be seen in cooler temperatures of the day.	60°-80°F temperatures Excessive moisture Excess thatch Inadequate nitrogen Shallow watering
f. _____	Infected turf is covered with white or light grey fungus. These turf areas may be as large as 2' in diameter.	28°-45°F temperatures Overabundant, excessive snow Excessive thatch Excessive growth of turf before winter weather
g. _____	Circular spots 2"-6" in diameter are killed. As the disease intensifies, these spots run together. Leaf blades turn brown, lie flat, stick together, and give a greasy appearance.	80°-95°F temperatures Excessive moisture Excessive shade Soil compaction Poor drainage
h. _____	This disease appears as circles or arc in the lawn. The center of the arc appears to be normal with the circumference of the circle dark green with the more rapid growth. The band also is characterized by the presence of mushrooms or "toad stools."	

TEST

(NOTE: If the following activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

11. Select appropriate grasses for various conditions and zones. (Assignment Sheet #1)

12. Locate and describe local turf insects. (Assignment Sheet #2)

13. Locate and describe local turf weeds. (Assignment Sheet #3)

14. Describe symptoms for various turf diseases. (Assignment Sheet #4)

15. Answer questions using a chemical control chart provided by instructor. (Assignment Sheet #5)

16. Demonstrate the ability to:

    a. Seed a lawn using a hydromulcher. (Job Sheet #1)

    b. Overseed a lawn using a seeder. (Job Sheet #2)

    c. Sprig a lawn using a tractor tiller. (Job Sheet #3)

    d. Use a drop-type fertilizer spreader. (Job Sheet #4)

    e. Use a broadcast or rotary-type fertilizer spreader. (Job Sheet #5)

TURF IDENTIFICATION AND PESTS
UNIT V

ANSWERS TO TEST

1.

a.	14	h.	8
b.	7	i.	5
c.	3	j.	11
d.	17	k.	15
e.	2	l.	16
f.	1	m.	6
g.	10	n.	9

2.

a. Hydrogen
b. 7
c. 6.0-6.5
d. Lower
e. Clay

3. c, d, f

4.

a.	Fescue	h.	Bluegrass
b.	Seed	i.	Seed
c.	2¼" - 3"	j.	Putting greens
d.	Ryegrass	k.	Seeding
e.	Seed	l.	Sprigging
f.	6-8	m.	¼"
g.	Remove less than ⅓ of leaf		

5.

a.	Full sun	i.	¾" - 1"
b.	Sprigs	j.	St. Augustine
c.	Plugs	k.	Sprigs
d.	Sod	l.	Sod
e.	Seed	m.	1½" - 3"
f.	Full sun to partial shade	n.	Seed
g.	Plugs	o.	Sod
h.	Sod	p.	1" - 2"

6. Evaluated by instructor

ANSWERS TO TEST

7. Any three of the following:

   a. Is the turf variety adapted to this area?
   b. What kind of lawn is wanted?
   c. What special physical problems does the lawn have?
   d. How much maintenance is needed?

8. a. White grubs
   b. Billbug grubs
   c. Armyworms
   d. Cutworms
   e. Sod webworms
   f. Chinch bugs

9. a. 1) Crabgrass
      2) Annual bluegrass (Poa Annua)
      3) Johnson grass
      4) Bermudagrass
   b. 1) Dandelion
      2) Henbit
      3) Chickweed

10. a. Brown patch
    b. Rust
    c. Leaf spot
    d. Powdery mildew
    e. Dollar spot
    f. Snow mold
    g. Pythium
    h. Fairy ring

11.-15. Evaluated to the satisfaction of the instructor

16. Performance skills evaluated to the satisfaction of the instructor